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NATURAL HISTORY

Nov.-Dec.
1929

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BIRDS OF PARADISE

JOURNAL OF THE AMERICAN
MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

THE AMERICAN MUSEUM OF NATURAL HISTORY

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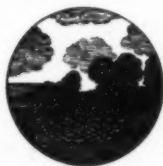
VOLUME XXIX
NUMBER 6

NATURAL HISTORY

NOV.-DEC.
1929

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price \$3.00 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York City.

NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership.

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

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BAKER'S BOWER BIRD
(*Xanthomelus bakeri*)

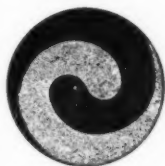
Adult male and young male of one of the new species discovered by Mr. Rollo H. Beck near Madang on the northern coast of New Guinea. The female is still unknown

VOLUME
XXIX

NATURAL HISTORY

NUMBER
SIX

NOVEMBER-DECEMBER, 1929



A COLLECTOR IN THE LAND OF THE BIRDS OF PARADISE

Collecting Brilliantly Colored Birds Among the Mountains of New Guinea—The Problems and Difficulties of an Ornithologist in the Savage Interior of One of the Greatest of Islands

By ROLLO H. BECK

Leader of the Whitney South Sea Expedition

WITH FIVE DRAWINGS BY FRANCIS L. JAKUES

After sixteen years of arduous adventure in the service of the American Museum of Natural History, Mr. Rollo H. Beck and Mrs. Beck had started homeward from the Solomon Islands in June, 1928. They looked forward to retirement and a well-earned rest in their California home. The heat, and danger, and swelter of nearly a decade among the far-flung islands of the South Seas, during the period of Mr. Beck's leadership of the Whitney South Sea Expedition, was soon to become only a memory in which happy episodes would crowd out any less pleasant to remember.

Mr. and Mrs. Beck had not even reached Sydney, Australia, on their homeward way, however, before a wireless message overtook them, proposing an additional year's work on the mainland of New Guinea. A study of the birds of paradise was among the naturalist's temptations mentioned in the message and, despite their homesickness, Mr. and Mrs. Beck turned northward again as soon as they had outfitted in Australia. Some of their experiences during the subsequent year are related in the following account, in which Mr. Beck tells of the discovery of a bird of paradise new to science, all the more remarkable because it was obtained in territory supposedly exhausted of such ornithological surprises.—ROBERT CUSHMAN MURPHY.

A bird of paradise called far across the cañon from our hut in Meganum, a little native village, twenty miles inland from Madang, the principal mainland port of New Guinea Territory. From far up the cañon another answered, and many times a day during the next six weeks we heard the strident calls of the yellow-plumed bird of paradise (*Paradisæa minor finschi*). Shortly after our arrival, Manube, our first shootboy, strolled out for a couple of

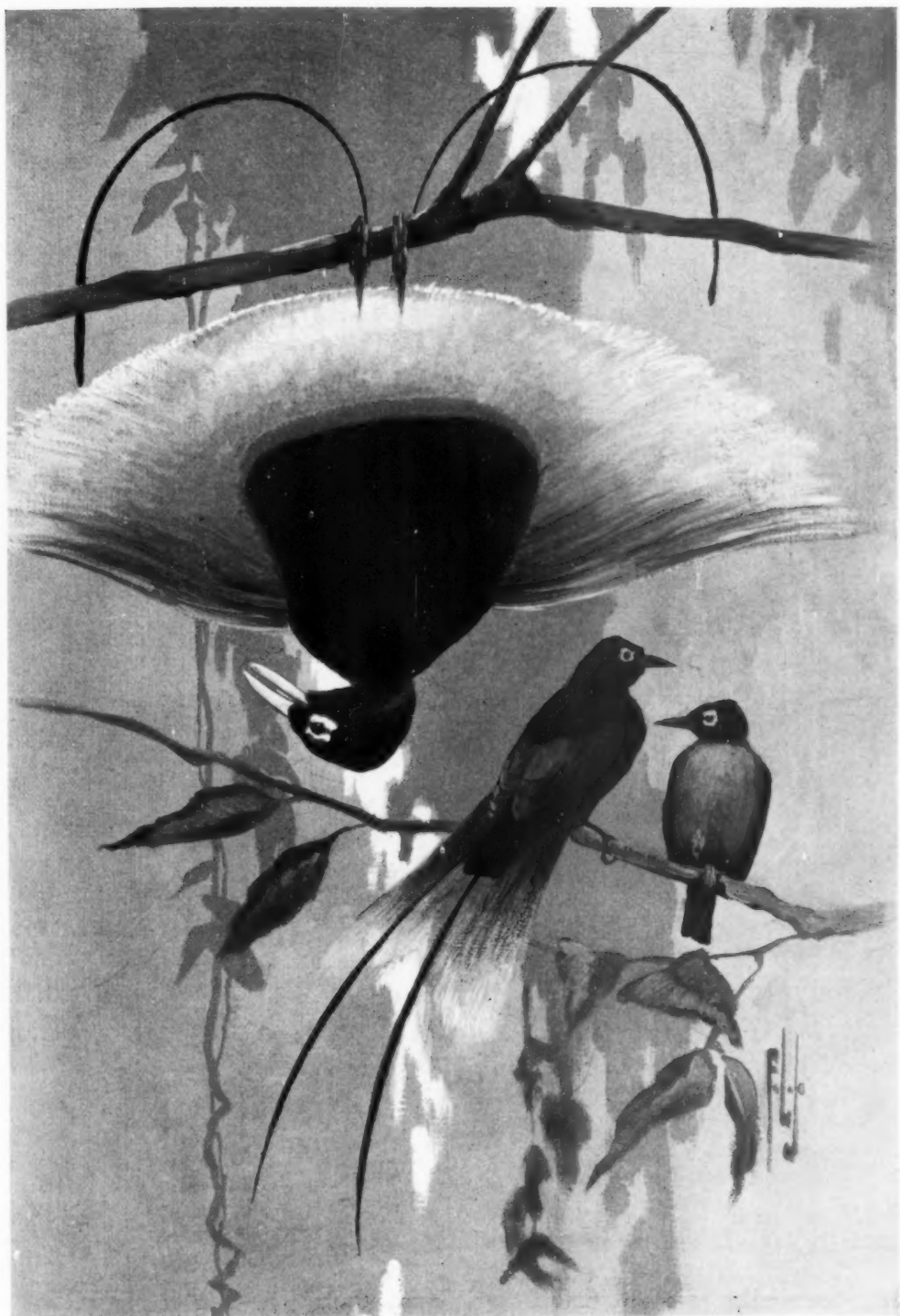
hours, and brought in the first three specimens of this species, all of them fine males, with the flowing plumes so beloved by the milliners of twenty years ago. The absence of these three individuals from the vicinity of our camp could not be detected by any decrease in the volume of paradisiacal sound that was audible daily, so we classed the species as common.

From several sources in the Territory I was told that most of the former German owners of plantations along the coast had



A SIX-PLUMED BIRD OF PARADISE
(*Parotia wahnesi*)

The beautiful jet-black body-feathers of this bird are topped by six plumes, also jet black. A tuft of bronze feathers grows directly over the bill, and the throat has an iridescent sheen of green and purple. One of these birds is here pictured in partial display



PRINCE RUDOLF'S BLUE BIRD OF PARADISE
(*Paradisornis rudolphi*)

Wholly unlike the usual attitude of display is the performance of the blue paradise bird. He hangs from the perch by his feet, spreading the feathers of breast and flanks into a living fan. Across this blue fan run bands of black and rufous. (See also the article by Lee S. Crandall, page 579.)



"MAIN STREET" IN MEGANUM

A village in the mountains inland from the town of Madang which is the principal port of eastern New Guinea. In the near-by forests, Mr. Beck collected some of his birds of paradise

paid for the clearing and planting of their properties by selling bird of paradise skins. At one port in the Territory several dozen old commercial skins were offered to me, but the law against killing and exporting this family of birds appears to be well obeyed at present, for within five miles from where these skins were offered I saw several and heard many of the same species.

That at least one New Guinea resident hopes for a repeal of the present drastic prohibitory law was evidenced by a communication sent recently to a Sydney (Australia) paper, wherein damage to cultivated crops in one section of the Territory was laid at the door of marauding birds of paradise. During my stay in the Territory I heard literally hundreds, dozens of these close to native gardens, but not one did I see feeding on cultivated plants. The usual food of several species, determined by stomach examina-

tions, was apparently wild berries of various kinds.

From the point of view of an experienced bird collector, Meganum is not an ideal collecting point. Nowhere on the various trails round about can one find a level stretch of ground fifty yards long. It is either steeply up or down, and birds of paradise as well as other species prefer the larger and highest tree tops to those within reasonable shooting distance. My first bird of paradise was a lucky fluke. While I was walking along a trail through high forest trees, a bird called ahead of me and I answered with a crude imitation. A small brown appearing bird lit over my head and a moment later dropped at my feet. Not till I stooped to pick it up did I see the long, gray, curled tail feathers, and it was much more surprising to see the same curling feathers change to dark metallic blue when their upper surface was viewed. But the multi-

tudinous colors of the bird when held in hand made one wonder where one's eyesight could have been when only a dull brownish bird had been the apparent target. Rich green were the underparts, while brown, yellows, and grays in various shades and patches marked the upper parts. A page would be needed to describe the color combinations of the back alone. This beautiful creature has been burdened with a name which is spelled *Cicinnurus regius similis*.

Later in the day a loud call and swishing wings drew my attention to a dark-colored bird that lit close to me. This proved to be another species of paradise bird, the rifle bird. Its shiny blue throat color changed to purplish green on the breast, while the velvet black back merged into a metallic blue crown on the head. When feeding, this species

often works down to the smaller trees of the heavy forest, but ordinarily it keeps to the higher parts of the largest trees. One bird that I kept hearing every half hour or so for several hours, changed his perch a dozen times during that period, but did not fly out of a half-mile radius from the original perch. Each male of this species seemed to me to have a definite area in which he moved, for, on several of my visits to a given locality, I would hear the same bird calling. Although I frequently tried to see certain individuals that I could hear calling in trees near by or mayhap directly overhead, only on rare occasions could the bird be observed. Sometimes the loud swish of the wings would give me notice of their passing in the forest, and on those sounds I based most of my attempts to get within reach of the elusive quarry. An interesting



AUGUSTA VICTORIA'S BIRD OF PARADISE
(*Paradisæa apoda augustæ-victoriæ*)

This bird, shown also on the cover of NATURAL HISTORY in full color, is among the most gorgeous of all the birds of paradise. In display the male stands on the perch with wings raised and long flank-feathers greatly expanded



MEETING THE STEAMER NEAR AITAPE

At certain ports along the New Guinea coast, fleets of canoes hover about the monthly mail steamer during its stay



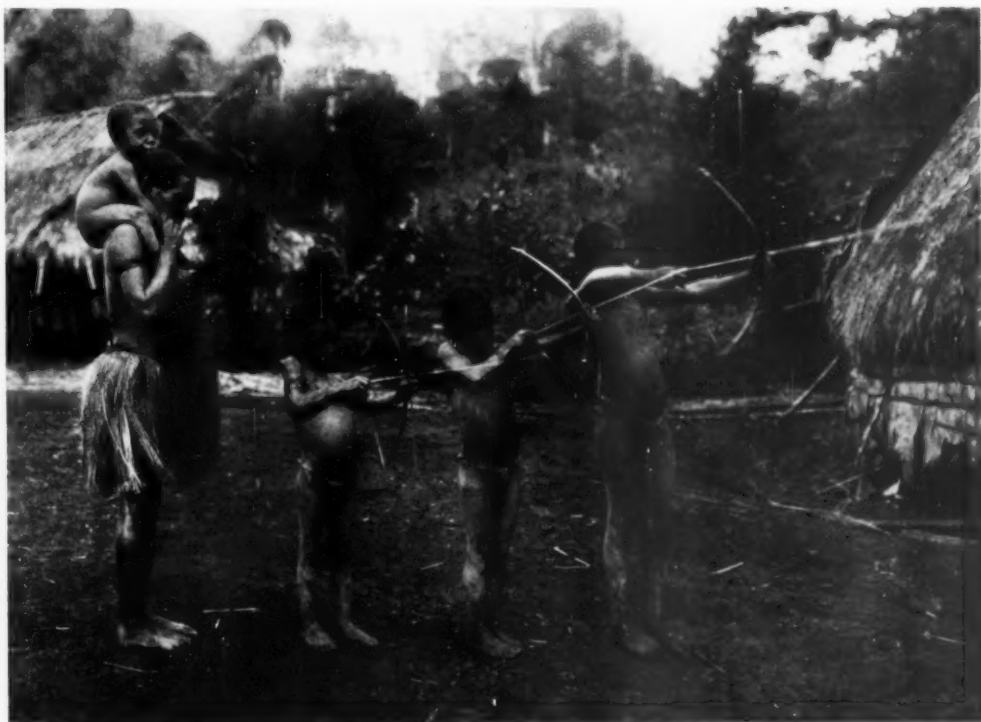
CROSSING THE GOM RIVER

The Government pays a monthly stipend to a native to ferry in his canoe all persons wishing to cross the river



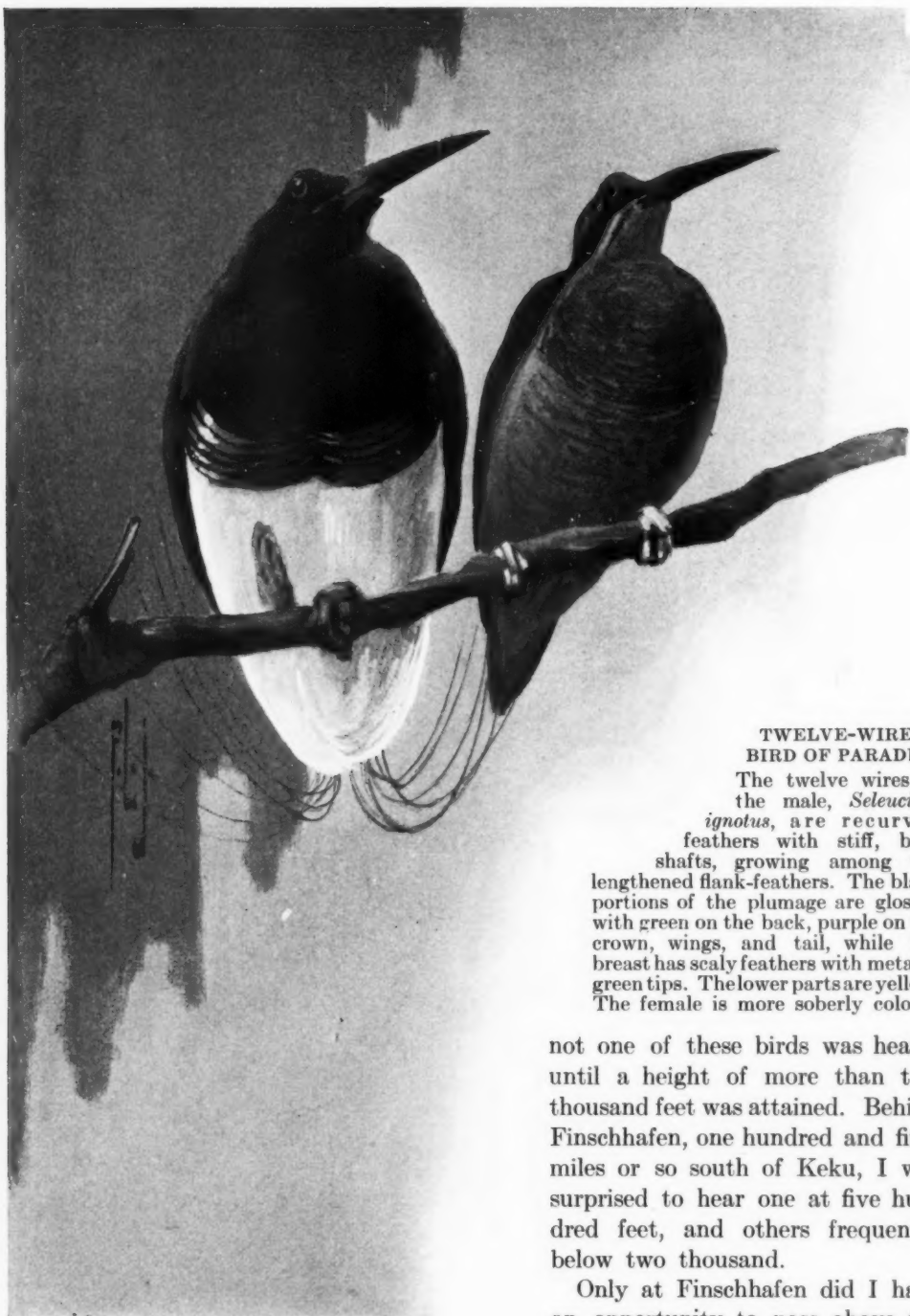
CARRYING TOBACCO TO MARKET

This group of natives is starting from its mountain village with a load of home-grown tobacco to be sold to plantation owners on the coast



EARLY TRAINING IN NEW GUINEA

Children of the mountain villages early begin their training with bows and arrows, which are highly important in securing various species of birds as well as opossums and kangaroos



TWELVE-WIRED
BIRD OF PARADISE

The twelve wires of the male, *Seleucides ignotus*, are recurved feathers with stiff, bare shafts, growing among the lengthened flank-feathers. The black portions of the plumage are glossed with green on the back, purple on the crown, wings, and tail, while the breast has scaly feathers with metallic green tips. The lower parts are yellow. The female is more soberly colored

not one of these birds was heard, until a height of more than two thousand feet was attained. Behind Finschhafen, one hundred and fifty miles or so south of Keku, I was surprised to hear one at five hundred feet, and others frequently below two thousand.

Only at Finschhafen did I have an opportunity to pass above the range of this species, the mountains about the first two camps exceeding little more than three thousand feet. This height was the extreme limit beyond which no birds

point, to me, about this species was the altitude at which it ranged at different stations. At Meganum, and at Keku, a station forty miles south of Meganum,

were heard when I worked inland from the port of Finschhafen. How closely birds keep to certain bounds was illustrated by the vociferous calls of another bird of paradise (*Paradisæa guilielmi*). This species begins to make itself heard plentifully at about twenty-two hundred feet, where it replaces a related species that inhabits the forest in the lower zone. From twenty-two it is heard regularly up to four thousand, where it abruptly stops. We spent some time at Zegaheme, which is four thousand feet and, though we heard and saw the birds often about the village and below it, when I climbed up a few hundred feet on the ridge

behind the settlement, the bird was missing, even though I could hear it calling a thousand feet below my trail.

At Zegaheme three birds of paradise new to me appeared. My acquaintance with one of them began when I crossed trails with my shootboy about noon the

A SUPERB BIRD OF PARADISE (*Lophorina superbalatipennis*) is here beginning to display his iridescent shield. His plumage is jet black with a bronze luster on the cape, and crown and breast-shield metallic green



first day. He was accompanied by a small boy carefully carrying (by a thread run through the nostrils) a long-tailed black bird which had a collar of burnished gold, separating the black of the throat from the bright green of the breast.

Another black-bodied bird had three long feather vanes tipped with tiny black feathers extending to the base of the tail, the vanes coming from just back of the eyes. A metallic patch of light green or dark blue feathers (depending on the angle at which the light struck them) covered the lower throat.

The third bird of the list was also blackish. Its throat was blue and had long points sticking out somewhat after the fashion of the present-day collars that I find New Yorkers wearing.

In addition to the pointed collar, this bird sports a beautiful ruff of soft, velvety feathers, which it raises or lowers as occasion demands. Whether these three species live much above six thousand feet I did not determine, my trips to seven thousand and above being too few to form an opinion. It was disappointing to me to find no specimens of the blue bird of paradise, its range beginning about five thousand above sea level. Apparently it does not range so far to the north, as none of the natives seemed to be acquainted with it.

Contrary to the habits of most species

of birds, the females were the more curious when investigations were to be made. Often a female would drop down quite close to me to have a good look, while the brightly colored male, if seen at all, would be flitting about high above. In addition

to the birds of paradise, pittas, small-sized ground birds, were on my list of extra desirable specimens. Although they were not rare, they proved to be very adroit in their movements.

Had it not been for some small boys at Keku whom I interested in trapping for me, the series would have been very meager. These youngsters built miniature duplicates of their fathers' pig traps in the forest, and by baiting with big grasshoppers or other convenient bird food, succeeded in capturing several



MRS. BECK EXAMINES A SPECIMEN
The bird, which is a hornbill, has just been brought in from the mountains near Madang by the expedition's "shootboy"

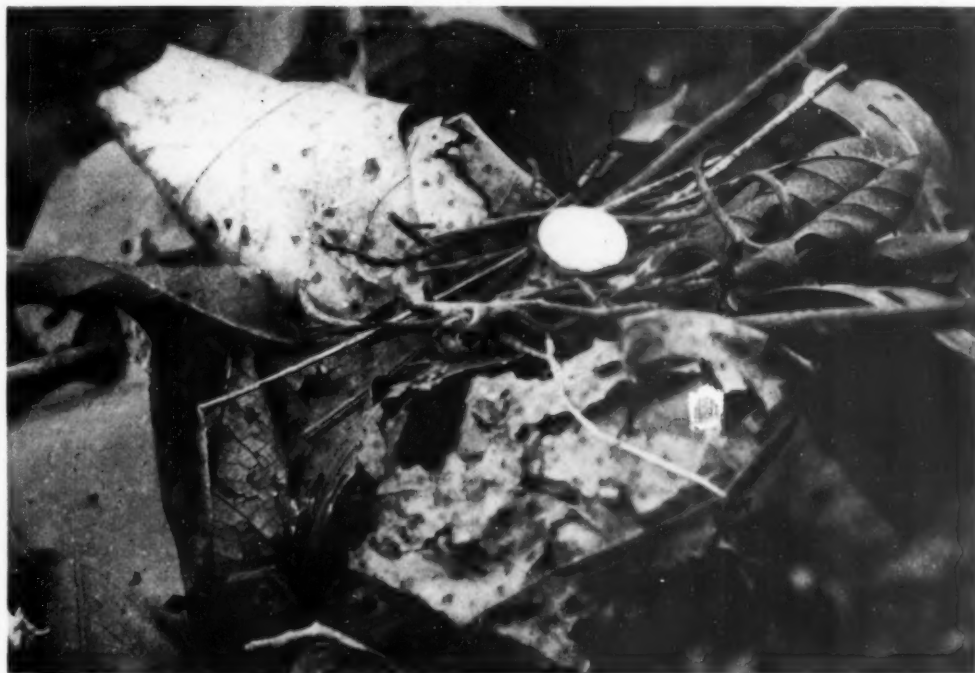
specimens of two species of pittas. They surprised me by bringing in also a number of kingfishers, caught in the same manner. In fact they brought me more long-tailed kingfishers (*Tanysiptera hydrocharis meyeri*) than I captured with the shotgun, although later I found it much easier to locate the kingfishers sitting in the forest. Often the slowly waving tail would be my first intimation that one of these beautiful birds was right in front of me. One evening after dark one of the boys working at a mission station brought in to me a freshly killed specimen of the blue-bibbed pitta. I



A NEST OF A BLUE-BIBBED PITTA

(*Pitta macklotii macklotii*)

The nest was discovered tucked away under a decaying log in a heavily forested cañon. No eggs were readily visible, so one was placed at the entrance while the nest was being photographed



THE NEST OF A RED-CAPPED DOVE

(*Ptilinopus pulchellus decorus*)

A few twigs, carelessly laid on top of some dead leaves, answers for the home of this beautiful dove. Although it is not uncommon in New Guinea, it is not often seen, due to its habit of frequenting the thick forest trees



A NATIVE "SINGSING" AT MADANG

When the Resident Commissioner makes his yearly visit to Madang, the mainland seaport of the Territory of New Guinea, the natives gather by the hundred, and, decorating themselves in gala attire, dance their oldtime dances for his pleasure



BEDECKED PARTICIPANTS OF THE "SINGSING"

This pair is awaiting the signal to begin dancing. The head of the drum is covered with a tightly stretched piece of iguana skin, this being the usual material for drum heads in that region



FIELD LABOR IN NEW GUINEA

These two women, who live in the New Guinea mountains, are preparing ground for the planting of taro, a crop upon which the natives are widely dependent. It is rather unusual for a mother to carry her child on her back while working in the fields



NEW GUINEA WOMEN PERFORM MOST OF THE LABORIOUS DUTIES

The women are planting sugar cane in a taro garden at Keku, New Guinea. Other plants introduced by the missionaries are also interspersed among the taro



CIVILIZATION ENTERS NEW GUINEA

With a plane obtained from the white men, this schoolboy planes a board for the schoolhouse in the background

asked him where he got it and how. He explained as follows:

"Bello, now me go drink water. Mama belong keow run away. Me lookim, now me come back. Long night time me go ketch im. Me come me giv im you."

Translated to plain English all this means:

"When the noon horn sounded I went down to the brook for a cool drink and saw a bird run away from its nest. I saw eggs in the nest, so at night time I went to it and caught the parent, bringing it to you."

This meritorious act earned for the boy a stick of tobacco and enabled me to get a photograph of the nest and an egg of the bird, one of the two the nest contained being broken when the bird was caught.

Glancing casually at the nest in situ, nine out of ten persons would see merely a jumble of dead leaves and the usual litter

which had fallen about the rotting log, while an oölogist looking for nests would likely note the structure and give it the second confirmatory glance. It was tucked away under a large decaying branch, in a shallow hole in the bank, and had at the sides and bottom long dead leaf stems as if they had fallen naturally. The roofing was cunningly composed of fresh green fern leaves and intermingling dry leaves in the usual forest proportions. Inside there was a thick lining of fine black rootlets on which the creamy spotted eggs showed plainly.

While sitting before the nest writing this description in my notebook, a tiny kingfisher *cheeing* through the forest lit over my head for the time it took to turn my eyes toward it, and then darted on its invisible flight to another perch. A larger



TOMATOES IN A TARO GARDEN

Missionaries have introduced many plants new to the natives. Corn, potatoes, pumpkins, cucumbers, tomatoes, and other vegetables are now occasionally to be found grown by natives who have come in contact with white men



AT WORK IN THE INTERIOR

In the mountains of New Guinea Mr. Beck usually had several natives waiting for the flesh of the birds whose skins he was preparing



MAKING A NEW GUINEA "RAINCOAT"

These garments, which are made of pandanus leaves, are suprisingly light and shed water well. In the higher mountains practically all the natives carry these, for heavy showers lasting from twenty minutes to several hours may occur at any time

kingfisher (*Alcyon azurea lessonii*) similarly colored, which flies up and down the mountain streams, reminded me often of the flight of dippers in California mountains, but the tiny one has its counterpart only in straight-flying humming birds, for by the time its call reaches the ear, the bird itself is yards away, *chee cheeing* as it goes.

One of the little birds that I always listened for was the pygmy parrot, two species of which I took in New Guinea. Its note is a most elusive *scree scree*, and frequently, although hearing the note regularly, I could not focus my eyes on the spot on the near-by tree trunk where the bird was. From the hotel porch in Rabaul the capital of the Mandated Territory, I watched several times the feeding actions

of the green species, while they worked up and down and under the limbs of the trees within twenty feet of me.

They repeatedly pulled off small bits of the dry bark, but just what they found underneath I could not determine. Like some species of kingfishers these little parrots use an occupied termite nest for their home. A cavity in one side of the nest appears to keep dry, even in heavy rain squalls. Just how they keep clear of the thousands of termites has never been explained to me satisfactorily.

This was just one of the many interesting, incidental questions that puzzled me on the New Guinea trip. There were many others, and still more await future collectors to the unknown mountains in the interior of that great island.



ON A DESERTED RUBBER PLANTATION NEAR MADANG, NEW GUINEA, THE NEST OF A COMMON KINGFISHER WAS FOUND HOLLOWED OUT IN THE CENTER OF A POPULOUS WHITE ANTS' NEST



A Visiting Motumotu Sailing Canoe on Hall Sound

TO NEW GUINEA FOR LIVING BIRDS OF PARADISE

An Account of an Expedition Sent to New Guinea by the New York Zoological
Society for the Purpose of Collecting the Strange and Beautifully
Feathered Birds of the Island's Forests

By LEE S. CRANDALL

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TWO skins of the greater bird of paradise, brought by the adventurers of Magellan's voyage around the world, in 1522, are believed to have been the first of these beautiful birds to have reached Europe. Like most native skins, even to this day, these specimens were without wings or feet. The unexplained lack of extremities, coupled with the ethereal beauty of the birds' plumage, gave rise to a great variety of conjectures of rashly romantic nature. For years it was believed that they "live in the air, always turning toward the sun, and never lighting on the earth until they die, for they have neither feet nor wings." Even as late as 1758, perfect skins were still unknown, and the great naturalist Linnaeus, quite possibly with his tongue in his cheek, designated the species as *Paradisea apoda*, the name it bears today.

In spite of the occasional visits of naturalists and explorers, this halo of romance still hangs over New Guinea and its near-by islands. Various professional collectors have gained fame through their labors and sacrifices in this forbidding country and more than one thousand species of birds have been described. Yet the supply of new bird species appears to be inexhaustible, and we know next to nothing of the life histories of this tremendous avian population.

There are several excellent reasons why zoological exploration in New Guinea has done little more than scratch the surface. The mainland of this great island contains a surface area of well over 300,000 square miles of almost impenetrable jungles and towering, inaccessible mountains, that offer every obstacle to the uncovering of their many treasures. A few great rivers,



LESSER SUPERB BIRD OF PARADISE
(*Lophorina superba minor*)

The southern race of a species collected also by Mr. Beck. (See p. 571.) Many of the shorter feathers of the metallic breast-shield of this bird have velvety black centers

such as the Fly and the Sepik, which are navigable by small craft for considerable distances, provide comparatively easy ingress to sections of the interior. But the huge mass of country, lying between the larger waterways, can be traversed only on foot. Food and equipment must be cut to less than necessities, for every ounce means an added burden for the reluctant native carriers, who never can be secured in sufficient numbers. This need of economy is increased by the extreme difficulty of the terrain. In some sections coastal swamps or plains must be traversed before the foothills of the great mountain ranges are reached. In others,

the mountains rise almost directly from the sea. Here the going is of the roughest, up and down sharp, razor-backed ridges, or along their narrow crests, ever climbing higher and higher. If there is a government or mission track to follow, the way is fairly clear, if not easy. When these are not available, native tracks usually can be found. A day spent in climbing an almost perpendicular mountain-side, on a native path, should convince the most rabid anti-evolutionist.

Tremendous areas have never been trod by foot of white man. Other great stretches have been "explored" by small parties of government officers, who have threaded their way through the wilderness, glad to return safely to civilization and report new mountains, lakes, or

rivers. Many years must pass before the last elusive "new species" of the New Guinea fauna is taken and described, and many more before the last life history is finally worked out.

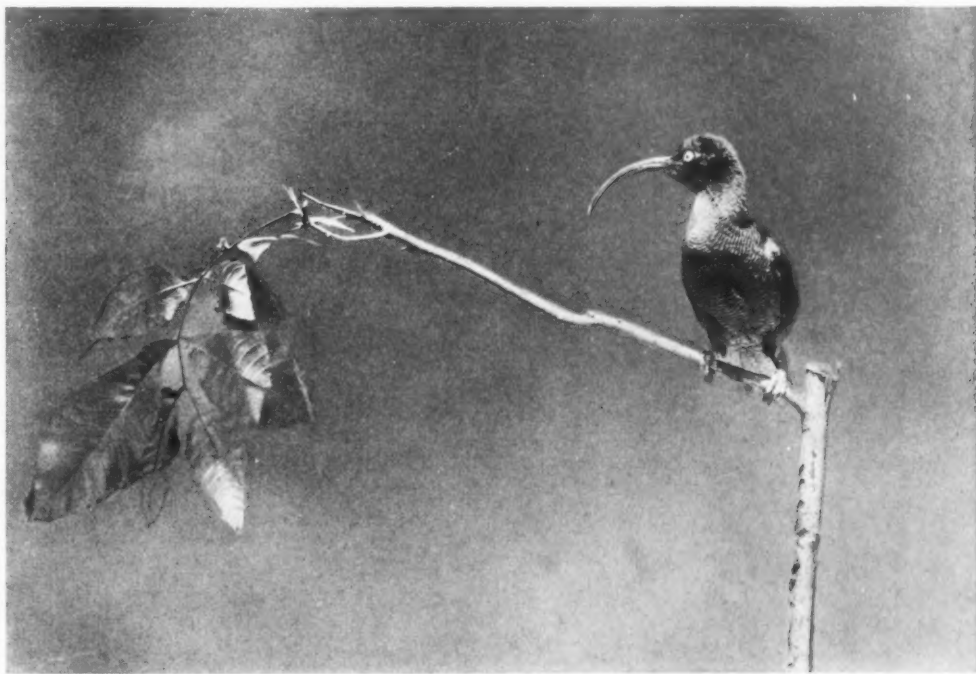
Since the primary purpose of all public zoölogical institutions is to attract the greatest possible number of people, and to attempt to arouse in them an interest in natural history, no birds can equal in value the birds of paradise. The brilliance of their plumage and the bizarre nature of their decorations set them apart as the world's most beautiful group of birds. Nearly one hundred forms are known, including several that are doubtfully

placed among the bower birds. Living specimens have always been uncommon in captivity—in fact, when three greater birds of paradise arrived at the New York Zoological Park in November, 1910, they probably were the first of any species ever to reach America alive.

The need of a fine collection of living birds of paradise has long been felt by the officers of the New York Zoological Society. In consequence, I found myself, early in October, 1928, established in a tiny, rickety "rest house" in a native New Guinea village. I was accompanied by Mr. J. E. Ward, of Sydney, Australia, and we had come in an attempt to secure for the New York Zoological Park the beautiful birds we had been unable to obtain by other means. I ought to say here that our final success was due chiefly to the knowledge, grit, and determination of Mr. Ward, whose previous experience

in New Guinea proved to be invaluable.

Our particular village was Inawaia, in the Mekeo District of the Central Division of the Territory of Papua, once known as British New Guinea. Mekeo is a plain of considerable area that extends northward from Hall Sound, about sixty-five miles west of Port Moresby. The natives here are of the Papuo-Melanesian group—that is, they appear to be the descendants of Melanesian immigrants, more or less intermixed with the true Papuans. They are mostly light brown in color, though occasionally very dark or very pale individuals are seen. The hair is of the "mop" type, long and bushy, and usually not tightly curled. It is seen to the best advantage in the men, who regard their coiffures with pride and give them constant attention. The women, on the other hand, are accustomed to wear their heads closely clipped, apparently for the excel-



LONG-TAILED BIRD OF PARADISE

(*Epimachus fastosus meyeri*)

This specimen is an immature male. The adult is chiefly metallic black and in length measures more than forty inches



PORT MORESBY FROM THE HARBOR

The seat of colonial government, Port Moresby is the first town of the Territory. It boasts of a number of substantial, well constructed buildings



A SEA-GOING CANOE

This clumsy craft, composed of two large canoes, decked over, was sailed to Yule Island from Motu-motu, a native village, about fifty miles to the west



A TRADING STATION ON YULE ISLAND

The headquarters of the Angabunga Company, known as Arure. The manager's house is seen at the right, with the store and boys' quarters at center and left



STREET SCENE IN SAMARAI

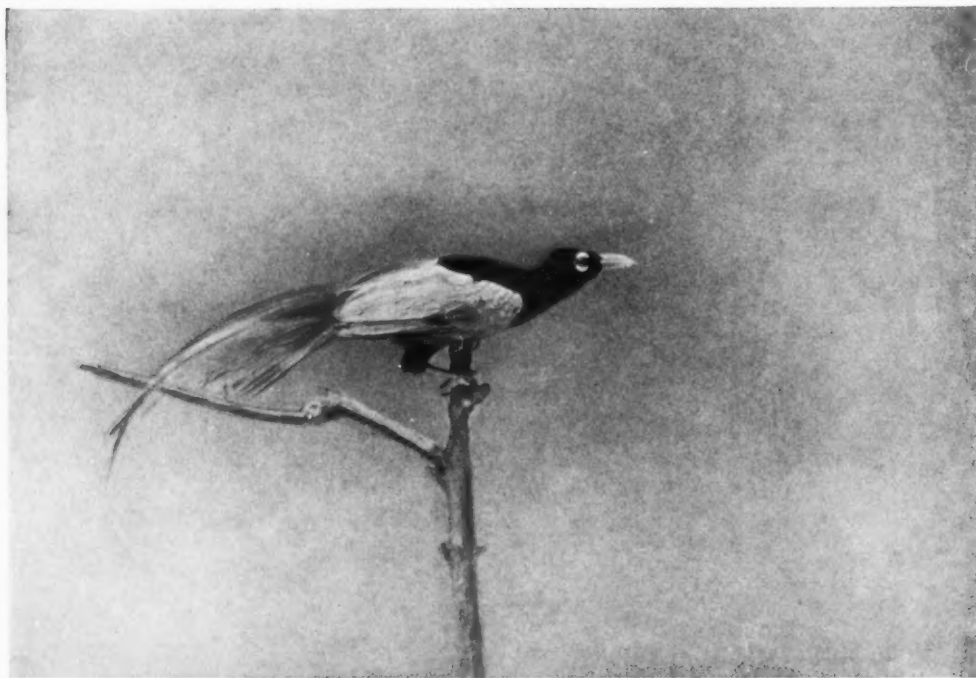
Situated on a tiny island at the extreme southeastern end of Papua, Samarai is the second town of the Territory. It is a green and lovely spot, in sharp contrast with dusty Port Moresby

lent reason that they are too busy in the gardens to devote much time to their personal appearance.

Clothing is confined to a perineal band for men and a grass skirt for women. The men, however, particularly those who are as yet unmarried, decorate themselves elaborately. The body is smeared with a heavy coat of cocoanut oil and red ochre, or some other reddish dye. Intricate and beautiful designs, in red, black, and yellow, are painted on the face, sometimes covering its entire surface. These patterns would repay study, for not only are they carefully done, but I never saw two alike. The designs are not the property of individuals, for each boy changed the pattern when redecoration was necessary. Pale green, scented *Colius* and *Croton* leaves are inserted in woven armlets and sometimes in leg bands as well. A deep cream or scarlet *Hibiscus* blossom, inserted

in the hair, completes a really striking effect.

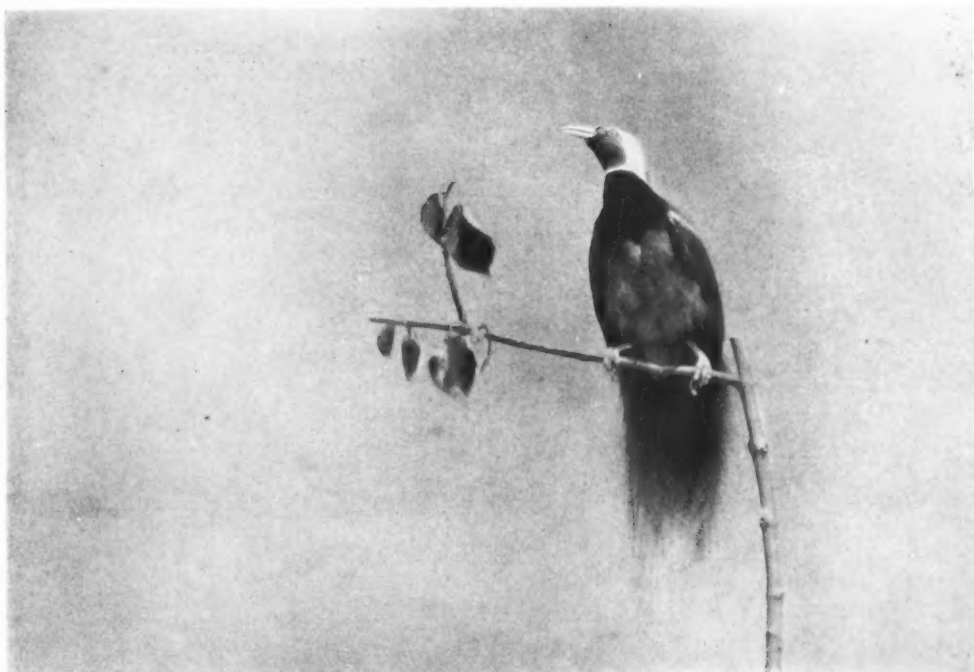
In common with most of the New Guinea tribes, the Mekeo people make use of the "dubu" or boys' house. Here the unmarried boys of the village live together, in theoretical isolation from their families. Actually, however, they continue to receive most of their food from the family pot. It is brought to them, usually in the evening, by mother or sister, who must retire immediately on leaving the offering on the platform of the dubu, for no woman may enter the sacred precincts. It is bad form, also, for a dubu boy to eat food before a woman, and none will willingly do so. This custom appears to have its origin in the desire of the unmarried boy to impress the women with the idea that he is a light feeder and that his wife would have an easy time in her garden. He wears a broad belt, drawn to really alarming tightness, to prove it.



PRINCE RUDOLPH'S BLUE BIRD OF PARADISE

(*Paradisornis rudolfi*)

Among the rarest and most beautiful of the birds of paradise, this species was one the expedition was most anxious to obtain. Seven specimens were brought alive to the New York Zoological Park



**COUNT RAGGI'S BIRD
OF PARADISE**

(*Paradisæa apoda raggiana*)

Of the group of typical birds of paradise, with long, filamentous side plumes, this is the only member found in southeastern New Guinea. The plumes are crimson, paling to brownish at the tips



**FAWN-BREADED
BOWER-BIRD**

(*Alphachlamydera cerviniventris recondita*)

A characteristic bird of the lowlands. The beautiful bowers, or play grounds, are usually found close to native tracks. They are easily located because of the noisy chattering of the bird as one passes near



BOYS' HOUSE OR "DUBU" IN THE MEKEO DISTRICT OF PAPUA

In most parts of New Guinea it is customary for the unmarried boys to leave the family circle and enter the dubu



OUR LANDING IN MEKEO

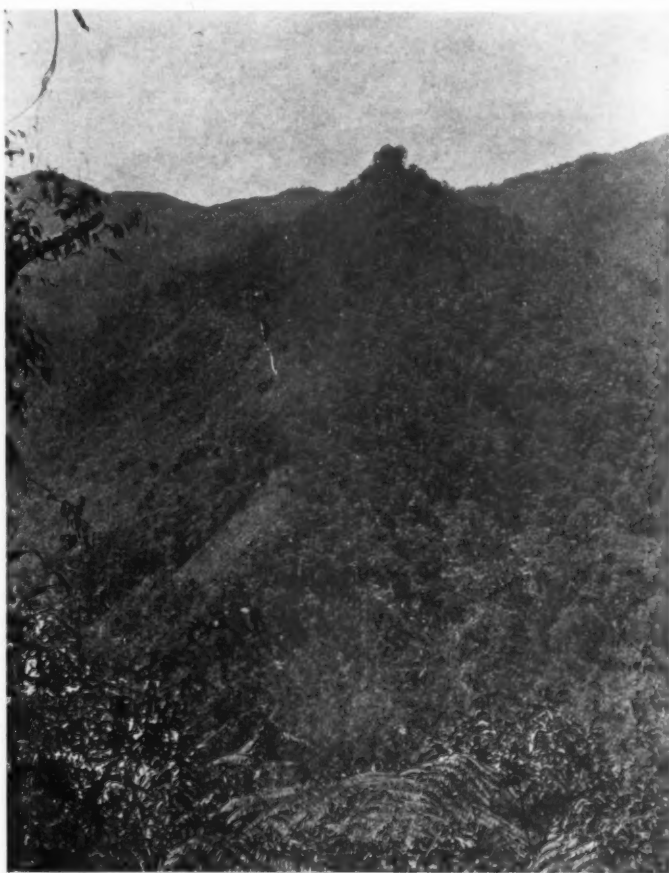
Just as the expedition finished unloading, the two boys in the foreground came along, on their way down river to a dance. The photograph shows the splendid physique of the Mekeo native

The Mekeo people undoubtedly have been cannibals, but under the influence of government and mission, have long since given up the practice. In fact, they express horror at the suggestion of such a thought. But this apparent abhorrence carries little weight, for even in remote districts, where contact with white people has been of the slightest, known cannibals will often vehemently deny that they have ever heard of a habit so disgusting.

The language of Mekeo is of Melanesian origin and apparently very difficult for a white man to master. However, many of the men are able to speak Motu, another Melanesian tongue spoken by the Port Moresby natives. This is a comparatively simple language and with a vocabulary of fifty or sixty words, which are easily acquired, one is able to get on very well. Extended conversations, of course, had to be carried on through an interpreter and in this capacity, the services of Koi, our cooky-boy, were constantly in demand. Koi was a Mekeo boy, but he spoke understandable pidgin-English, as well as several native dialects. The Mekeo country is quite flat and only a few feet higher than sea level. In a few scattered localities, high primitive forest still remains, but for the most part, the bush is low and intermingled with large patches of saw grass, which frequently is ten or twelve feet tall. Travel

through this grass country is ordinarily both difficult and unpleasant. However, it is occasionally burnt off during pig and wallaby hunts, and when the grass begins to grow anew, a very beautiful parklike effect results.

There are many birds here, of course—swarms of parrakeets and lories, flycatchers and honey-eaters—but only one bird of paradise is common. This is the green manucode (*Manucodia ater alter*), a black, crowlike bird which is very abundant from Yule Island to the foothills. The twelve-wired bird of paradise (*Seleucidetes ignotus*) probably occurs in Mekeo, where the sago palm grows, and Koi



MOUNT IOLA

This isolated peak rises from the floor of the Aya Valley, northeast of Deva-deva. The top is saddle-shaped, and on each point is a village. The two are known, collectively, as Iola



THE CHIEF OF JESUBAITBOA

In Papua a chief has practically no control over the individual actions of his people, except as they may affect the general good of the community

PARTICIPANTS IN THE DANCE

Adornment for such social occasions is carried out with elaborate attention to detail. The ornaments are handed down from generation to generation





MOTUMOTU NATIVES

These people come from near the mouth of the Lakekamu River, about fifty miles west of Yule Island. They probably represent the purely Papuan type



BAGGING COPRA

The dried coconut meat is being packed for shipment on the launch which took the expedition to Jesubaiboa. The skirted man at the left is a boat boy

assured me that the magnificent bird of paradise (*Dyphyllodes magnificus hunsteini*) is sometimes found there also. At the northwestern edge of the district, just

than two hundred feet, we heard the raucous calls of the magnificent rifle bird (*Craspedophora magnifica*), a beautiful black bird of paradise, which inhabits the



MEKEO WOMEN AT THE DANCE

Women are invariably reluctant to pose for photographs and pictures are difficult to get. The elaborate decorations are well shown, particularly in the figure at the left. The woman at the right is not participating

before the foothills are reached, I saw the only king bird of paradise (*Cicinnurus regius claudii*) that was recorded during the expedition.

After some difficulty in organizing a staff of carriers, we set out on the long march to the mountains, which lay to the northeast. During the second day we reached the first of the foothills, and here, at an elevation of less than one hundred feet, we heard the first call of Count Raggi's bird of paradise (*Paradisæa apodaraggiiana*). Thereafter, even at elevations of six thousand feet, the piercing notes of this splendid species were constantly in our ears.

At Kubuna, where the elevation is less

mountains up to about two thousand five hundred feet. From Kubuna, the elevation rises abruptly so that traveling became very strenuous indeed. After three days of hard marching we finally came to a point known as Deva-deva, at an elevation of about four thousand feet, in the western extension of the Owen Stanley range. The place takes its name from a native village that once existed there and on which we had relied for food. Unfortunately, the former inmates had scattered up and down the lovely valley of the Aiya River, so that there was no food to be had. Most of our boys immediately deserted, leaving us in an alarming fix. The reduced size of our party, however,



A VILLAGE DANCE IN MEKEO

These dances are purely social affairs, given by one village, to repay similar courtesies of their neighbors. On this occasion, ten Mekeo villages were the guests of Eboa



A PHASE OF THE DANCE

The steps are graceful and dignified, in perfect time with beats of the drums carried by the men. The women in the foreground are waiting to join in at the proper time



AYA, THE EXPEDITION'S BIRD BOY

Aya finds it difficult to control his expression, because the other boys are making fun of him

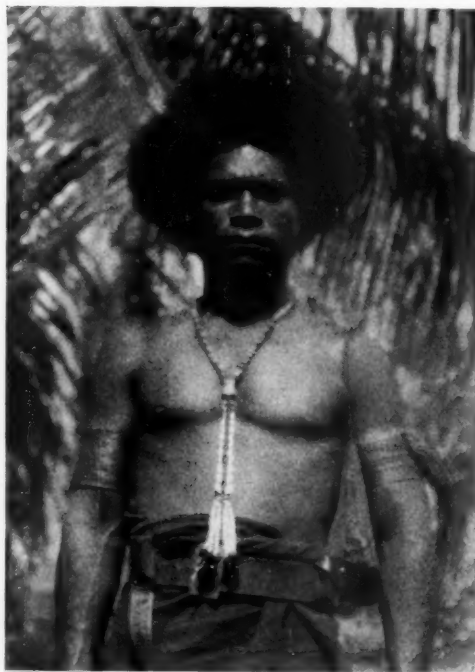
undoubtedly increased the confidence of the local natives, who eventually came in and made friends.

The Deva-deva people belong to the Kuni tribe, whose boundaries extend northwestward to the Mafulu country. In appearance, the Kuni people are quite different from those of Mekeo. They are noticeably shorter in stature, averaging hardly more than five feet one inch. They are much darker in color and oblique eyes are common. I noted several people with strikingly Mongolian features, including oblique eyes. The hair is not worn in the bush formation of Mekeo, and usually is covered with a headdress of bark cloth. It seemed to me that climatic conditions have made this custom necessary, for in the mountains rain falls heavily nearly every day. The mountain native goes about indifferently, his hair safely protected. The Mekeo boy, on the other hand, is very reluctant to have his mop

dampened and will always seek shelter if he can.

The Kuni language, while apparently fundamentally Melanesian, is quite different from that of Mekeo, and of all our boys, only Koi was able to make himself understood. Under his benign influence, the people quickly overcame their natural shyness of white men. They soon began to bring us small supplies of sweet potatoes, and after further persuasion and the display of trade knives and axes, they began to bring us the birds we had come so far to get.

The magnificent bird of paradise (*Dyphyllodes magnificus hunsteini*) is very abundant here and in spite of our assurance to the natives that we did not want this bird, they brought us more than we could take. Lawes' six-plumed bird of paradise (*Parotia lawesi*) and the lesser superb (*Lophorina superba minor*) were



OPU KAKI, VILLAGE CONSTABLE
OF JESUBAIBOA

Opu is a splendid specimen of the Mekeo native, excelling in physique and intelligence. He is well known throughout the district

almost as numerous. Mt. Kebea, which lies between Dilava and Deva-deva, and rises to a height of about six thousand feet, seems to represent the limit of the southwestward range of Prince Rudolph's blue bird of paradise (*Paradisornis rudolfi*). This beautiful species is very local in distribution and only a very few living specimens have been taken. Consequently, our efforts were concentrated on securing it, but it was only when we had begun to refuse others that our constant persuasion began to have its effect and our first blue bird was brought in. Whether because the blue bird lives very high up the precipitous slopes, or from some superstitious dread, the natives are reluctant to take it. However, a nice, shiny, seventy-five-cent trade ax is a powerful argument against superstition, in the eyes of people who use axes of stone to clear the forest for their gardens. Seven lovely blue



A DUBU BOY FROM EBOA

This boy came frequently to visit the expedition at Inawaia, but would pose for his photograph only when he considered his toilet perfect



A BOY FROM THE VILLAGE OF WAIACKA

A typical dubu boy, in his everyday finery. Unfortunately, the camera failed to pick up the intricate pattern painted on his face

birds of paradise, landed safely in New York, witness this fact.

At the last moment, a pair of young long-tailed birds of paradise (*Epimachus fastosus meyeri*) were brought in. This is the largest species of the group, the adult male reaching a length of more than forty inches. It is found in the high mountains northeast of Deva-deva, and we had hardly hoped that even the promise of an ax would cause the hunters to go so far afield.

After many difficulties, caused chiefly by lack of carriers and scarcity of food, we succeeded in getting our precious collection down to Mekeo, where no one who can live on sweet potatoes and excellent bananas is likely to starve. We stopped again in Inawaia, for some weeks, to make further collections, and just as we were about to leave, I had the great good fortune to be able to witness a native

dance, a thrilling experience. This event took place at Eboa, a village about two miles to the north of Inawaia.

This dance was of purely social character, given by Eboa, to repay the inhabitants of ten neighboring villages for similar entertainments previously enjoyed. Such an affair cannot be arranged until the host village has accumulated a great store of surplus food, which requires months of planning and hard work. We heard excited talk of this dance almost as soon as we reached Inawaia on our first arrival, but it failed to materialize, and I thought I should miss it entirely. However, it actually began the day before we were to leave, and I had full opportunity to make observations, photographs, and moving pictures.

The actual dancing is of a graceful and dignified character, performed by both men and women, to the beat of drums, carried by the men participants only. The costumes are both weird and

beautiful, many of the men wearing magnificent headdresses composed largely of the plumes of Count Raggi's bird of paradise. As individuals tire, their places are taken by others, the performance going on continuously, day and night, for three or four days, without pause longer than a few seconds. At the end of this period, when everyone is thoroughly exhausted, there is a great feast, at which the village pigs are killed for the guests. It is a curious fact that no one ever dreams of eating his own pig.

We left New Guinea on December 10, 1928, but it was not until March 21, 1929, that our forty birds of paradise, in company with some two hundred other specimens, finally reached New York. Soon after their arrival, a number were presented to the zoological gardens of other American cities. Those that remain at the New York Zoological Park are now in perfect condition, displaying their handsome plumage daily to the delight of our visitors.



MOTUMOTU CANOE IN THE LITTLE HARBOR AT ARURE, YULE ISLAND
These coastal people are skilled seamen. Their double canoes are propelled by both oars and sail, and can hold their own in heavy seas



A view on the coast of Dominica

THE MOUNTAINS OF DOMINICA

The Two Highest Mountains in the Lesser Antilles, Diablotin and Trois Pitons, on Which Plant Life Is Still in the Process of Ascent and Increase

By PAUL GRISWOLD HOWES

Curator of Natural History, The Bruce Museum, Greenwich, Connecticut

PHOTOGRAPHS BY THE AUTHOR AND DICKENSON S. CUMMINGS

THE highest and most beautifully forested of the Lesser Antilles is Dominica, which lies about midway between Guadeloupe and Martinique.

In Roseau, the capital, we heard strange stories regarding the mountains we had come to investigate. Few people have climbed Trois Pitons and Diablotin, and no accurate observations have ever been recorded so far as Dickenson Cummings and I could ascertain. Even more confusing and vague were the accounts of some who claimed to have reached the summits, and many of their statements were too absurd to record.

We were assured that the time we had selected to climb Diablotin (between March 2 and 14), was not the proper time at all, but no one realized that we were basing our plans upon actual meteorological records carefully prepared for this very purpose upon a former expedition. As it finally turned out, we were correct. We encountered ten days of

perfect weather, but during the remainder of our stay in the island we saw the top of the mountain emerge only once from the clouds.

There is no place in the world where it rains harder or longer, once it sets in, than in Dominica, and I do not hesitate to say that it can be the windiest and most disagreeable, or the sunniest and most delightful country of all. One must know actual conditions in order to succeed in mountain work there, for, though the mountains are not high, they are difficult to ascend and explore.

We were told that the Diablotin region abounded in huge boa constrictors that "hung from every tree," and various other good-natured little dangers were rumored about for our special benefit, but we took these warnings philosophically.

In addition to all this, our search for data before leaving the United States had resulted in the following interesting information—the mountain Diablotin might



CLOUDS COVERING THE SUMMIT OF TROIS PITONS

The round leaves in the foreground are those of the "Ka-klanh" tree that here, near the summit, has dwindled into bushes. This tree exudes a disagreeable sticky slime whenever bruised or cut

be any height from 4747 feet, by authority of the maps, up to say 5313 feet as the *Encyclopædia Britannica* has it, a mere difference of 563 feet!

And so, after despairing of finding out anything of particular value in advance, we decided to ascend Trois Pitons first. It was close to our headquarters on the estate of Captain Struan Robertson, 1800 feet above sea level, and would supply us with the desired information as regards the zones to be encountered, the best methods of working, and the equipment necessary, so that we might know just what conditions we would have to face in the ascent of Diablotin in March.

Having waited many days for the weather to settle and in the interval having missed one or two clear afternoons when the clouds had lifted entirely from the mountains, we finally decided rather unexpectedly to make the ascent on the morning of February 16.

Our guide, Son Esprit, had sent a message that was never delivered, but upon his arrival with two porters for the trip, we soon were off, leaving Sylvania about nine-thirty o'clock.

The clouds hung leaden and heavy over Trois Pitons, curling down from the summit over the cloud-forest below and then evaporating as the warmer air met this vapor from above.

Leaving the trail, we crossed two rivers almost at once and found ourselves in a magnificent forest of great trees which even at this low altitude were already coated with a delicate blanket of feathery mosses, for, as we found later, this mountain is the highest in the island and therefore catches the maximum of moisture from the clouds above.

The zones on Trois Pitons and upon all of these Dominican mountains are startlingly abrupt. At 2500 feet on Trois Pitons, one runs into that strange area

where the big forest of the sub-tropical zone merges with the cloud-forest; a few feet above this, the big forest disappears altogether, leaving one in a gloomy, dripping place, inhabited by spindly trees, shaggy with dark-colored mosses. Again, at 2650 feet, a change is noted, the trees becoming stunted and fantastically gnarled, and covered with calumet vines; and at 3300 feet comes the true central cloud-forest with its dwarfed, twisted, and otherwise deformed trees, weighted and staggering under countless parasitic and epiphytic plants and dripping mosses that gush forth their water at the slightest touch.

Under foot there is deep, sticky mud, and as the mountain-sides grow steeper and steeper, and the vegetation more stunted and tangled, progress without a previously marked route ends in exhaustion and total loss of direction.

To make matters worse, we were making the climb during the endless rainy weather of the spring season, and because of the peculiar manner in which the trees grow out from the mountain instead of up in the usual fashion, it was necessary to walk and climb and pull the body hand over hand through the slippery limbs for hundreds of feet at a stretch.

We forced our way ahead to 3500 feet and here for a brief period we encountered more open country because of the hurricane that

during the previous September had ravaged these mountains. We were now above the clouds, and far below on the Caribbean a tiny steamer could be seen headed toward the north.

The hurricane which hit Dominica was the same one that ruined Porto Rico. From our lofty observation point we could see the strange tricks that such a storm can play. Some of the mountains were untouched, but others were covered with heavy jungle on one side only, while the other side was swept almost free of vegetation. Viewing them from a distance, I could not help but liken them to a man with a heavy growth of beard who had shaved only one side of his face.



BESIDE THE TRAIL

The vegetation at an elevation of 1850 feet on Trois Pitons includes a plant known locally as "staghorn"



A BROMELIAD AT THE BASE OF A GOMMIER TREE

The bromeliads are parasites, the leaves of which hold water harboring all kinds of life from amœbæ to amphibians. This plant was 6 feet 8 inches high

We made photographs and records from this point and then continued our laborious way through trees that grew smaller and more stunted as we ascended. We passed through masses of lava from ancient upheavals, explored dingy, dripping caves in the clouds, and fell a dozen times into watery holes and crevasses, fortunately without serious results; then, as suddenly as we had encountered the cloud-forest, we left it and found ourselves in another world.

A tree, called by the natives "Kaklanh" or "Fig" had been encountered almost from the start of the trip. We were conscious of it continually because of a disagreeable, heavy slime which it exuded whenever bruised or cut. This sap was extremely sticky, and our clothes and hands were smeared with patches of black. It never came out of our clothes, and it was some days before we were able to remove the last of it from our skins.

At the base of the mountain these trees were twenty-five feet in height, but as we ascended they became smaller and smaller until finally they dwindled into bushes and became the dominant vegetation up to an actual *tree line* fifty feet from the summit.

We had been told that the top was all rock, but such was not the case. No more beautiful or fantastic spot could be imagined, for the whole ground was covered with countless small bromeliads that looked something like the leafy parts of pineapples. There were bromeliad bushes also, if one might call them such, consisting of fifty or a hundred small plants all stemmed together and growing as a living whole. White, gray, red, salmon, and emerald green mosses, were here also, and two or three varieties of low bushes, one in orange flower, constituted the summit vegetation for the most part. There were absolutely no trees, but a rock stuck



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THE FALLS IN SALTOUN GORGE

This picture graphically illustrates the difficulties of exploration in the mountains and gorges of Dominica. Note the fall at the lower right issuing from an invisible source



SON ESPRIT—GUIDE

This native, who knows more about the mountains of Dominica than most white people, having spent his 76 years among them, told the author at the outset that Trois Pitons was higher than Diablotin

up here and there, and upon the highest one our aneroid registered 4600 feet.

It was cold and very windy, and we had to hold the tripod to keep it from blowing off the mountain. The men, used to the heat of the lower levels of a tropical island, crouched in the bushes shivering, despite the rum that had been served liberally to all hands. Clouds made seeing difficult at times, and the moisture condensed upon the glass and metal of the camera and fell from the instrument as rain.

Two things that seemed of importance stood out in my mind after we had returned to our headquarters. One was the fact that an actual tree line had been encountered, and that we had found a treeless summit. The other was that our chief man, Son Esprit, had stated that the top was all rock and that he had not made the ascent in some time. He also ex-

pressed surprise at certain forms of vegetation which we had found when nearing the top. The significance of these things I will speak of later.

On March 2 we left Roseau for the ascent of Diablotin. We traveled by launch to the little village of DuBlanc, where Mr. Shillingford, a native of Dominica, gave us every possible assistance. From here we proceeded with eleven porters up the hills to the plateau at Milton, where we pitched our base camp near the great lava gorge of the DuBlanc River. From here we directed the cutting of a passable trail to 3400 feet on Diablotin, where a second camp was established and made ready. This camp was a typical native hut of boughs and palm leaves, called an *adjoupa*. Another one was constructed by our men for themselves, less elaborate than ours, and then the trail was continued to the summit.

On March 9 we moved up from the base



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A PRIMITIVE DOMINICAN

All types were met during the expedition, but this was the most primitive mental type found—a man who was bewildered and frightened by the camera's shining eye



MEMBERS OF THE EXPEDITION

Paul Griswold Howes, the author of this article, stands at the right. The other white man is Dickenson S. Cummings. The negroes are local natives

to the *adjoupas* with our equipment. With us were five men: Baptiste, our own man; John Joseph, who spoke English and assumed a slightly superior air; Casimer, lean, with tremendous lips, and muscles like iron; Toulon, loud, talkative, and gay, a huge fellow, who staggered up the cliffs and through the labyrinth of the forest with a seventy-pound load; and Sicite Ploui, woodsman, hunter, and the proud possessor of mustachios and an ancient shotgun. As mascot we took a dog, whom Cummings appropriately christened "Bromeliad."

We had not gone far before Sicite spied a ramier, or wild dove. It flew from the forest floor to a limb, perched for a moment of observation, and then made off through the trees. We saw it plainly, but our hunter, wishing to impress us, placed his gun to his shoulder, cocked the hammer with much difficulty with the aid of his cutlass, and then pulled the trigger.

He had fired at the spot where the dove had been fully a minute before, and now the whole forest vibrated with a deafening roar. Flame belched from the gun, and a huge cloud of smoke enveloped everything, while a shower of newspaper wads and glowing sparks fell all about us. The charge blasted away leaves and branches, and was truly a remarkable spectacle, and then to make the whole procedure more ridiculous, Sicite insisted upon searching the ground minutely for his bird!

This part of the forest of Diablotin is much like that on Trois Pitons, but the trees are of greater diameter and very beautiful. We climbed up slowly and were nearing our second camp when we heard a strange squeaking and twittering in the ferns and begonias near by. Upon investigating, we witnessed a furious battle between two tiny plumbeous warblers. They rolled about in a gray,



A DISTANT VIEW OF DIABLOTIN

The long ridge leading to the summit of Diablotin is plainly visible in this view, which shows the mountain fifteen miles distant



© Paul Griswold Howes

SUBTROPICAL GROWTH ON DIABLOTIN

This beautiful forest lies at an altitude of 1700 feet. It was through such growth that the expedition was forced to travel in order to reach the summit of the mountain



© Paul Griswold Howes

THE FIRST PHOTOGRAPH EVER TAKEN FROM THE SUMMIT OF DIABLOTIN
The Y-shaped mark in the middle distance is the result of a huge landslide that removed a great strip of forest from the other mountain



Photograph by Dickenson S. Cummings

MR. HOWES HIGH ON MT. DIABLOTIN

Here the leader is shown in the expedition's native camp at 3400 feet elevation. The hut is made of palm leaves



© Paul Griswold Howes

THE CARIBBEAN SEA

From 3400 feet up the side of Mt. Diablotin. This picture was taken from one of the expedition's camps. In the center distance is the bay and the town of Portsmouth

squeaking ball of feathers and dirt. Never have I seen such a display of fury in such tiny bodies. Still more remarkable is the fact that all about them sat a gallery of their own species, cheering on the combatants and apparently enjoying the spectacle enormously.

It was late when we reached camp and found a wet howling wind blowing through our hut. The roof was dry, but the floor consisted of heavy mud. Besides this, we were badly infested with fleas which had overrun everything at our base camp, and things were not too comfortable. A huge roaring fire was successfully kindled only because we had remembered to collect a good quantity of Gommier gum from the trees below. Everything is saturated with water and soaking moss covers all the branches up in these mountains. Soon we were making ready a pot of steaming erbswurst, and we were just settling down to a

little comfort, when a delegation of shivering men came grumbling to our *adjoupa*.

With the exception of Babtiste, they had all decided to try to intimidate us. Dissatisfaction with their rations, which were all too good, was the excuse for the trouble, and they demanded more food.

In the growing darkness of the abrupt Dominican night, these disgruntled black men, each armed with a long gleaming cutlass, looked rather unpleasant by the light of the fire. We stood our ground and refused point-blank to add to their rations, although actually we had been cooking an extra large batch of erbswurst in an old kerosene tin, as a special treat for them. If they wanted more food they could go back down the mountain and get it, and that ended it. They looked at one another, and their cutlasses flashed in the light of the flames, but we held our gun, which was a good gun, and we had demonstrated it



© Paul Griswold Howes

A HAZY VIEW FROM DIABLOTIN

Looking toward the Atlantic side of Dominica. A faint white line may be seen at the upper left-hand corner which is the surf on the Atlantic coast



© Paul Griswold Howes

A STRANGE VEGETABLE WORLD

At the top of Diablotin and of Trois Pitons the expedition found such growth as this. In the water gathered by the leaves of these weird plants strange life forms were found. Insects, worms, and tiny frogs of the *Eleutherodactylus* group lived among the vivid mosses. The ground vegetation was very simliar on the summits of Diablotin and Trois Pitons



© Paul Grinwold Howe

THE TREMBLEUR

Cincloerthia ruficauda ruficauda

Found only in Dominica is the trembleur, a strange brown bird of the mountain forests that droops and trembles its wings and holds its long tail above its body. It feeds upon everything from hard nuts to tree frogs. Here it is shown one-third life size

not without reason earlier in the day, just for good luck.

They backed off to their hut, but Sicite, the gloomiest of the lot, went down the mountain again. Before morning he returned but, as far as we could find out, he brought no extra food. All the other men were cheerful and happy.

The last part of the climb on Diablotin is more exhausting than that on Trois Pitons, but conditions are very similar as regards the vegetation, until the top is reached.

After coming out into the open, we proceeded along a gradual ridge which may be seen plainly miles away from the mountain. We walked along this ridge on the edge of a great cañon and looked down on smaller mountains that had been ripped and scarred by the hurricane. The view is superb over endless great valleys

and mountains, and the surf may be seen breaking all along the northeastern and eastern shores, while great masses of cloud drift by or about one, changing the scene every minute. Our photographs had to be shot through the holes in the clouds. The dense masses to the south and southwest prevented pictures being made in those directions, but as the ones we did secure toward other points of the compass were the first ever taken from the summit of this mountain, we felt well satisfied.

Diablotin was supposed to be the highest mountain in Dominica, but to our great surprise our instrument registered 4550 feet, or fifty feet lower than Trois Pitons. At the top we found one other record left by Mr. Tavernier of Roseau, some years before, and at 4450 feet another bottle contained the date and the names of a party headed by Mr. Aird and



© Paul Griswold Howes

A PARROT FOUND ONLY IN DOMINICA

Amazona bouqueti

While common in Dominica and encountered frequently by the members of the Howes-Cummings expedition, this bird occurs no place else in the world. Shown slightly over one-third life size



ANOLIS LIZARDS

These lizards possess yellow throat fans which they extend when excited, and after eating

Mr. Archer, that did not reach the summit.

Undoubtedly our readings are correct, especially in view of the conditions which we found on the two mountains. The summit of Trois Pitons is treeless and the tree line lies about fifty feet from the top. On Diablotin there are trees fifteen feet high, almost at the very peak, and one of my photographs shows palms growing along one of the highest ridges.

It is very interesting that the vegetation appears still be to creeping up these mountains. They are not high enough to allow of permanent tree lines as in greater ranges, and I firmly believe that in the future trees will reach the top of Trois Pitons and that they will become more numerous on Diablotin.

As to the readings of Diablotin which ascribe to the mountain an altitude of 5000 feet or more, let it be said that 5000 feet would be 450 feet higher than we recorded it, which would also make the plateau at Milton 450 feet higher, or 1850 feet. This would be absurd, for the reason that the plateau is a grassy, un-forested area, with underbrush and clumps or lines of medium-sized trees, with many life forms living upon it that are charac-

teristic. Anyone who knows Dominica, or who has paid the slightest attention to conditions as they actually exist, knows that an altitude of 1850 feet or even less, anywhere on the Caribbean side, would carry one into the heavy subtropical forest zone with its attendant living forms.

Recalling what Son Esprit had said about the top of Trois Pitons, it appears that noticeable changes have taken place even between the time he went up with us, and with a former party. I should like to climb these two mountains fifteen years from now.

The zoölogy of the mountains is of much interest also, but I shall have to mention it briefly. At the top of Trois Pitons we heard frogs calling, and at all levels on Diablotin, from base camp to summit, we collected specimens of the remarkable little frog called *Eleutherodactylus antillensis*. They become paler as the altitude increases, and it is interesting that they have reached the top of this island world.

These frogs have no tadpole stage at all that is free-swimming. The entire process



A COMMON BUTTERFLY

Colænis julia Fabr.

A butterfly characteristic of the Milton Plateau at 1400 feet elevation. It extrudes a strange gland which smells strongly of banana oil and which has the power of attracting the opposite sex



AN ANTILLEAN BROAD-WINGED HAWK

Buteo platypterus antillarum

This bird, which was captured alive by the expedition is of a common species. Stomachs examined contained giant centipedes and spiders, and the birds were frequently seen eating or carrying the black and white snake, *Leimadophis juliae*. The species is shown about one quarter life size

takes place within the unusually large eggs, which are deposited upon the ground. The young frogs step out of the eggs perfect in every detail and are about the size of a black-headed pin!

There is plenty of life up on these mountains, for the stomachs of these frogs contained flies, two kinds of beetles, and many ticks and mites. In the water caught by the leaves of bromeliads, black worms and other semi-aquatic creatures were thriving.

Molluscs in the form of land snails have reached the summit of the mountains also. A variety of *Bulimulus guadeloupensis* inhabited the plateau at Milton (1400 feet) and also a small, flat-shelled species of *Amphibulima*. The beautiful snail, *Pleurodonte josephinae*, occurred up to 3400 feet, where a number of the shells

were found beside a rock where they had doubtless been cracked open by the thrush, *Chichlherminia dominicensis*.

Species of *Neocyclotus* were also found well up on the slopes of Diablotin; this may possibly be a new species. At the summit of Diablotin I found a beautiful horn-colored *Amphibulima*, its shell streaked with delicate, waving lines of brown, and another as yet unidentified snail with a high spiral shell.

Land crabs were not uncommon in the subtropical zone of both mountains, and the streams on the lower slopes were inhabited by hundreds of shrimps and many of those strange gobies, fitted with suction discs for clinging to stones in the roaring mountain streams. The species which we found was *Sicydium punctatum*. The fishes were feeding upon algæ.

Insects were numerous, but space prohibits a discussion of them in this article. I must mention, however, a large green mantis from 1500 feet on Diablotin that was quite different from any other species I have taken in Dominica.

Bats were encountered, but not at the higher levels, while bird life was much in evidence. The Imperial parrot, *Amazona imperialis*, and the smaller *Amazona bouqueti* both inhabit Diablotin, and the latter was seen several times on Trois Pitons. *Imperialis* is scarce, but *bouqueti* was seen many times every day during our Diablotin expedition, and on one day we saw seventeen.

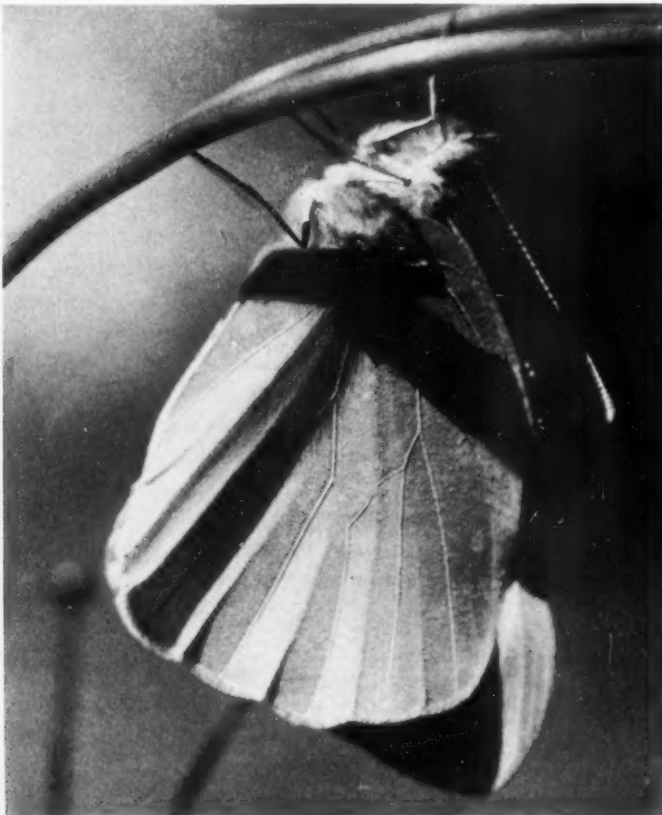
On the grassy plateau at Milton and in the rows of trees and the thickets which grew here, twenty-seven species of birds were found including anis, cuckoos, four flycatchers, two warblers, two finches, and

a grossbeak, a wren and a honey-creeper, three thrushes, and a solitaire called the mountain whistler (*Myiadestes dominicanus*), which is peculiar to the island. There was also a comical bird, the trembleur, *Cinclocerthia ruficauda ruficauda*, with the habit of continually drooping and trembling its wings, a swift, and four humming birds, the Antillean broad-winged hawk, *Buteo platypterus antillarum*, and a wild pigeon and a dove.

All of these except the Imperial parrot were found also between our headquarters at 1800 feet and the top of Trois Pitons, but birds were scarcer on the higher parts than on Diablotin, although the Dominican sparrow, *Pyrhulagra noctis dominicana*, flew over the very top of it while we sat making our notes! Near by, but not actually on Trois Pitons, at 1850 feet, Cummings and I secured a specimen of

the very rare *Euphonia flavifrons* three days before the end of our trip. The only other record of this we know of is that of Ober made in 1887.

Our time, was far too short for our purpose, and there is doubtless a great deal more of interest and value to be found out about these rugged mountains. I hope sometime in the future to climb them again, in order to check up on my predictions.



WHITE PIERID BUTTERFLY newly emerged from its chrysalis. This species sometimes appears in great broods, both at sea level and high in the mountains. About four times life size



A TROPICAL RELATIVE
OF THE KATYDID

SOME INSECTS FROM BARRO COLORADO

A Region of the Panama Canal Zone Where Insects of Peculiar Shapes and Habits
Carry on the Never-ending Struggle for Existence—How They Kill and in
Turn Fall Prey to Enemies

BY C. H. CURRAN

Assistant Curator, Department of Insect Life, American Museum

Mr. Curran, assistant curator of insect life at the American Museum, spent several months early in 1929 studying the insect fauna of the Canal Zone, particularly Barro Colorado.

Barro Colorado was originally a headland on the shores of the Chagres River. When the Gatun Dam was closed, the surrounding lowlands were flooded and the water level rose 85 feet, making of the headland an island that stands 452 feet above the lake.

The 3500 acres comprising the island are heavily forested, and support an essentially primeval fauna of the greatest interest to scientists and naturalists. Through the efforts of Mr. James Zetek, specialist in tropical insects, U. S. Department of Agriculture at Washington, D. C., the United States Government has set aside Barro Colorado as a laboratory for students of tropical animals and plants, and has placed it under the care of the Institute for Research in Tropical America.

Mr. Zetek, as resident custodian, has earned the gratitude and esteem of all visiting scientists by his unflagging interest and assistance in their scientific investigations. Another resident of the Zone whose influence is felt is Mr. J. B. Shropshire of the Army Sanitary Division. In work carried on in the Zone Mr. Shropshire was always at Mr. Curran's service and much of the success of the entomological studies in the Zone is due to his coöperation. Dr. William H. Weston, professor of botany at Harvard University, also gave much of his time to the preparation of the insect photographs in the following article.

THE EDITORS

IN no part of the world is the eternal struggle for existence so obvious as in the tropical regions. There animals and plants are engaged in continual warfare, and even the casual observer in the wooded region, or "jungle," cannot fail to be impressed by the rapidity with which death swoops down upon the ever watchful inhabitants of the "underworld." No animal is safe; no plant is secure. In the case of all living things, enemies are awaiting the opportunity to destroy that

they themselves may live. The mighty giants of the forest are brought to earth by the ravages of insects, fungi, and wind; the larger animals succumb to others of greater or less skill, which possess the advantage of being able to make surprise attacks.

Among animals, the insects very greatly exceed in point of numbers of individuals as well as species, all the other animals found in any given portion of the world. Not only do insects make war upon all



ON THE BEACH AT BRUJA POINT

The swamp land to the right provided a breeding place for countless *Anopheles* mosquitoes, and the ravages of malaria once made the region almost uninhabitable. Drainage by the Army Sanitary Division eliminated the conditions favorable to the mosquitoes, and malaria is now practically unknown hereabouts

the animals and plants in their neighborhood, but they war upon one another. If any analysis were made, therefore, it would be found that they have, in reality, many more enemies than any other one group of the animal kingdom.

Since they are so preyed upon and their lives are so precarious, it is not surprising to learn that insects secure protection in many ways. As a rule they are unable to defend themselves, and once fairly in the grasp of an enemy, they are doomed to destruction. Since they are weak defensively, how do they escape their enemies? Is it by speed or by concealment?

Speed seemingly plays but a small part in the safety of insects. One evening a bat-hawk, having set himself up in the top of a dead tree near our laboratory on Barro Colorado Island, made numerous sorties after large moths. He never

missed. On one occasion a moth escaped the first plunge, but with the speed of lightning the bird wheeled, and before the moth had gone a dozen feet in its mad flight to escape, the bird had grasped it in its claws and was carrying it to the treetop, there to devour the tasty morsel, the torn wings drifting slowly to the ground a hundred feet below. So speed is no real measure of safety.

Concealment in the direct sense is the safeguard of many insects, but its limitations are evident. Yet, if we include under concealment such terms as protective coloration, deceptive form, and so-called mimicry, it may be said that insects find concealment to be their greatest protection. To the observer of insects it soon becomes obvious that under certain conditions some insects are almost invisible even when in full view

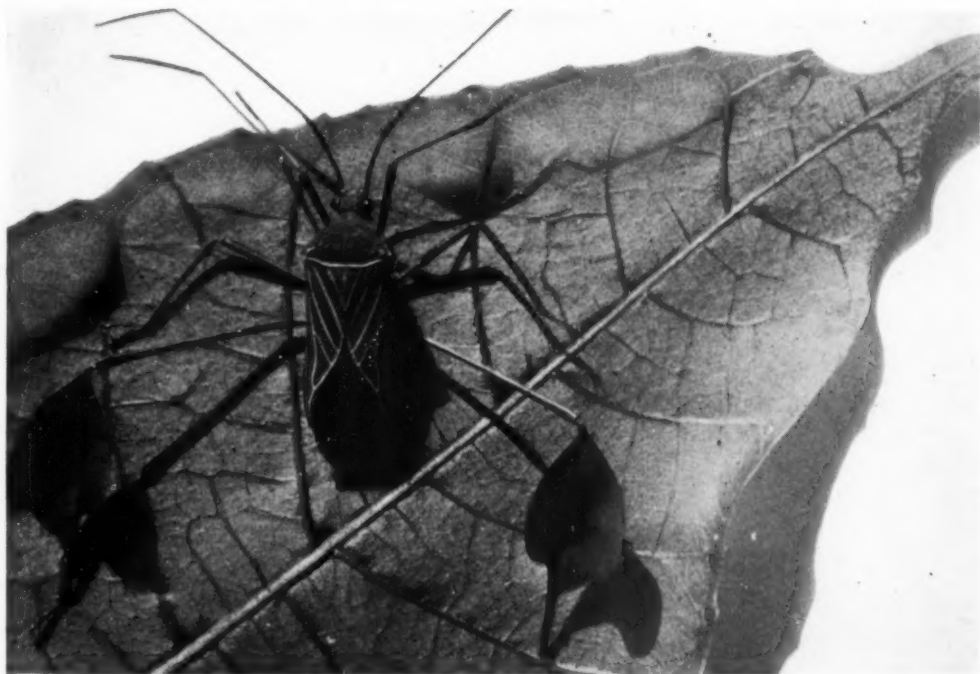
and but a few feet distant. If their presence is betrayed, it is usually because of some movement on the part of the insect. It may seem a strange anomaly to assert that it is motion which warns an insect of the presence of an enemy, and at the same time it is usually some motion on the part of an insect which acquaints an enemy of its presence.

INSECTS OF PECULIAR SHAPE

One finds, as a rule, that insects which have developed in such a way that they are bizarre in appearance have formed the basis of a great many papers dealing with tropical forms. As a result of this, the opinion prevails that the tropics are full of weird six-legged creatures which may be secured in almost countless numbers. Yet the visitor to the tropics would be exceptionally well repaid could he find three or four creatures so bizarre as to attract more than usual attention.

It will be gathered from this that bizarre forms are rare, and this is indeed the case. Many insects of strange structures are quite small, and it is only when they have been examined under a powerful microscope that their peculiarities become strikingly apparent.

One day while walking along the trail at a point where the growth was no higher than ten or twelve feet, I saw what appeared to be a brown, twisted stem of a leaf, or a dried portion of a leaf, wafted downward from an overhanging bush. But it did not reach the ground. Instead it made an upward sweep and came to rest on the slender stem of a plant. It was one of the little tree hoppers, or brownie-bugs, as they are sometimes called, and as it rested upon the stem, its peculiar shape might well have deceived any observer into the belief that it was merely a piece of dried leaf stuck to the plant. On Barro Colorado there



THE AIRPLANE BUG

This assassin bug lives fairly close to the ground, although its name and structure would seem to indicate that this was not the case



A STALK-EYED FLY

The wierdest fly occurring on the American continent and known only in the tropics. In life it is even more grotesque than it appears here

are at least two more tree hoppers of striking form. One of these is said by James Zetek to be the original pawnbroker's sign, as it bears upon its back three swellings which do remind one of the pendent spheres. This little "brownie" is quite common. Whether its unique armor is of much service as a means of protection is open to question.

Occasionally the bushes on the side of the trail will harbor two or three ferocious looking bugs belonging to the family of which our common squash bug is a member. In the several instances that these were observed, almost always two male bugs were found on the same bush, rarely three, never a single individual. Had they been in pairs, one might have concluded that here was marital fidelity among the bugs, the two sexes going happily about the business of enjoying life together. Evidently the opposite was true, and they could not get along peacefully, because the males seemed to enjoy each other's company and to travel in pairs. Why? It is a problem still to be solved and one which promises to be of interest.

Many flies are found resting beneath the leaves of the Panama hat palm (it is not a true palm), especially if the plants grow

in close proximity to a stream. Some of these creatures are of unusual structure and one of them has its eyes situated on the ends of long stalks. This is one of the two really "stalk-eyed" flies known from America, yet they are not closely related to the true stalk-eyed flies of the Old World tropics. So far as could be observed, the development of the head serves no useful function. Perhaps it has grown in this way in order to please the eye of the female, which is an ordinary looking individual with a normal head.

Possibly the males look quite dangerous to other insects; certainly the outline, as the fly rests on a leaf, always on the under surface, is scarcely fly-like.



AN ASSASSIN OF THE TRAILS

An assassin fly, crouched in waiting attitude ready to spring forth and inflict death upon any unwary insect which may come within range of its clutching legs

SOME INSECT ASSASSINS

Assassins are numerous in the insect world. Many entire families of insects prey upon others, pouncing upon them suddenly during flight, lying in wait for the unwary individual that comes within their domain, or pouncing upon their victims after a stealthy approach.

On many of the very low shrubs which spring up on the trails, there rests an assassin ever alert, turning its head this way and that in search of some flying insect which would furnish a much-needed meal. These assassin flies, or robber flies as they are usually called, though they never rob anything but life, are extremely strong, and an insect, unless it be of much larger size



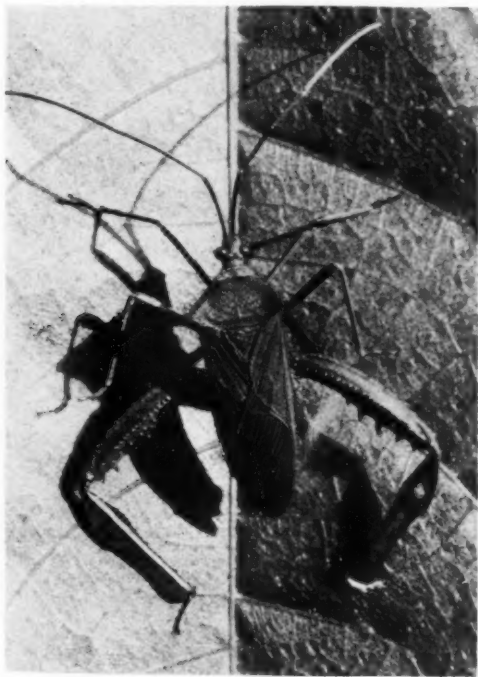
THE PAWNBROKER'S SIGN

The common and wierd treehopper enlarged several times, carries three globular swellings above its back

than the would-be murderer, has little chance of escaping from the clutching legs of the aggressor. Some of them live almost entirely upon bees, in some unaccountable manner escaping the searching sting as the bee fights for its life.

The stink bugs are evil smelling creatures. A very large, green kind with orange stripes is very often met along the trails. It takes to the air very readily upon the approach of danger, and for this reason often escapes recognition. It enjoys a meal of caterpillars, although other insects also seem palatable to it.

Among the assassin bugs is a peculiar creature in whose hind legs the tibiae have become expanded into an orange and yellowish mottled leaflike structure. To this bug Zetek has aptly applied the name of "airplane bug." It is not difficult to imagine it soaring high above the treetops, skimming along with little alar effort. However, it lives fairly close to the ground and may be found resting upon leaves, eager to locate some other insect to furnish it a meal. One afternoon I observed a relative of the airplane bug sitting on a leaf enjoying a repast of stingless bee. On the same leaf, evidently attracted by the dead insect but careful to keep out of reach of the living one, were two tiny flies.



A VICIOUS LOOKING BUG

Related to the squash bug, this creature looks dangerous, but it is not. It lives on the juices of plants. Perhaps the huge hind legs cause it to appear ferocious to its enemies



A SANITARY DIVISION BUILDING IN SCENIC SURROUNDINGS

A view from France Field, Army Air Station, on the Atlantic side of the Isthmus. The building is used primarily for the storage of tools needed for the digging of drains for the elimination of mosquito breeding places



A TREE HOPPER

The droll facial expression of this insect has suggested the name "brownie bug," by which it is sometimes called

They seemed to be anxious to secure some of the meal. Perhaps they intended to await the end of the assassin's dinner, and then themselves feast upon what remained.

"LANTERN" FLIES

On the side of a cliff-like slope leading up from a small stream, stood a tree with quite a smooth bark and patches of lichens scattered sparsely on its surface. To the human eye, it was apparently not at all different from others of its kind scattered through the forest. But to one species of lantern fly (*Fulgorid*) it must have had some special attraction for there seemed to be quite a large colony permanently residing on its trunk. They sat there, some thirty or more, usually one above the other, in rows of four or five, scattered on the shady side of the tree. The formation was not unlike that of soldiers engaged in an attack, each keeping

the proper distance from the other. But the Fulgorids are no soldiers, and their green, gray, yellowish, and white waxy bodies stood out conspicuously on the tree trunk. When frightened off, they flew a short distance and found temporary quarters on some other tree, but they always came back. Why was this tree selected above all others? This is another question still to be answered.

Many Fulgorids resemble moths. The resemblance can scarcely be any protection, but nevertheless it is very great, especially when the insect takes wing or rests upon the underside of leaves. The family contains many examples of remarkable structure and beautiful coloration, as well as numerous dull colored forms.

GRASSHOPPERS AND ALLIES

Most people will agree that the katydids are graceful creatures, and that their cheery song is not unwelcome music



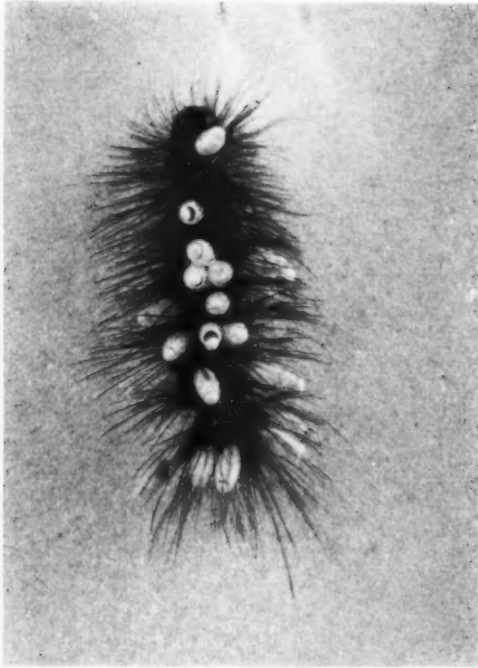
AN INSECT CONVEYANCE

This walking stick served as a unique chariot for a pair of biting midges. The larger wingless female has a yellow body and is shown to the right of the male



LIKE SENTRIES ON GUARD

Together with many others of their kind these two Fulgorids sat for days on the same tree trunk. "Lantern flies" are not luminous, as the name implies, and are not flies. They are bugs



DEATH

The parasites formed their white cocoons and departed before this caterpillar succumbed

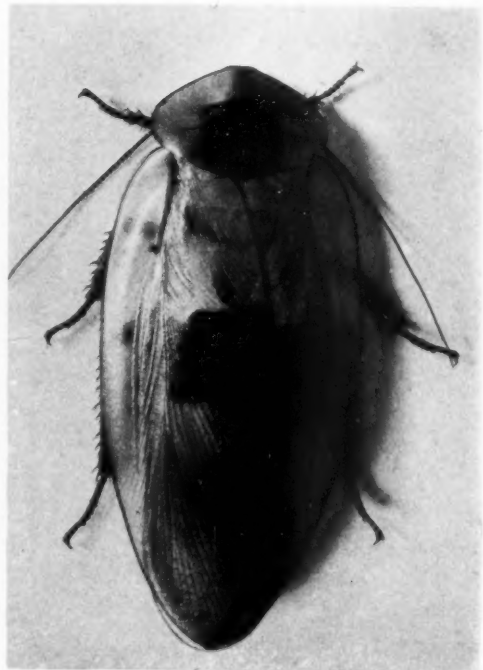
during the night in northern regions. Many of their relatives occur in the tropics, some of them quite conspicuous. One common species closely resembles in color the dead leaves among which it spends much of its time, flying, when disturbed, to some neighboring low bush or tree trunk. Another has antennæ or feelers about three times as long as its body, and the female possesses a very strong ovipositor. The so-called "ears" of the grasshopper, located on the front tibiæ, show up very strongly in the picture on page 619.

Occasionally a large cockroach found its way into the laboratory. These did not make themselves disagreeable, and they were really "strays," preferring the free life of the open spaces to the confines of the building. They were not beautifully colored as many of their kind are, and were therefore conspicuous only because of their great size, their length

averaging a little more than three inches.

Walking sticks are familiar friends, and many species occur in Panama. They do not always walk. Many of them fly, and their flights, in which their colored under-wings are conspicuous, might well lead to confusion as to their identity. One of them appeared to assume the rôle of an insect passenger plane.

It had been commandeered as a means of transportation by a pair of tiny biting midges. Such an association is truly remarkable, and it also happens to be rather necessary as far as the travels of the flies are concerned. The male fly is furnished with wings, but not so his meek but fat little wife. She knows not what it is to soar through the air by her own volition, so to overcome the defect in her transportation equipment and in order that she might enjoy the



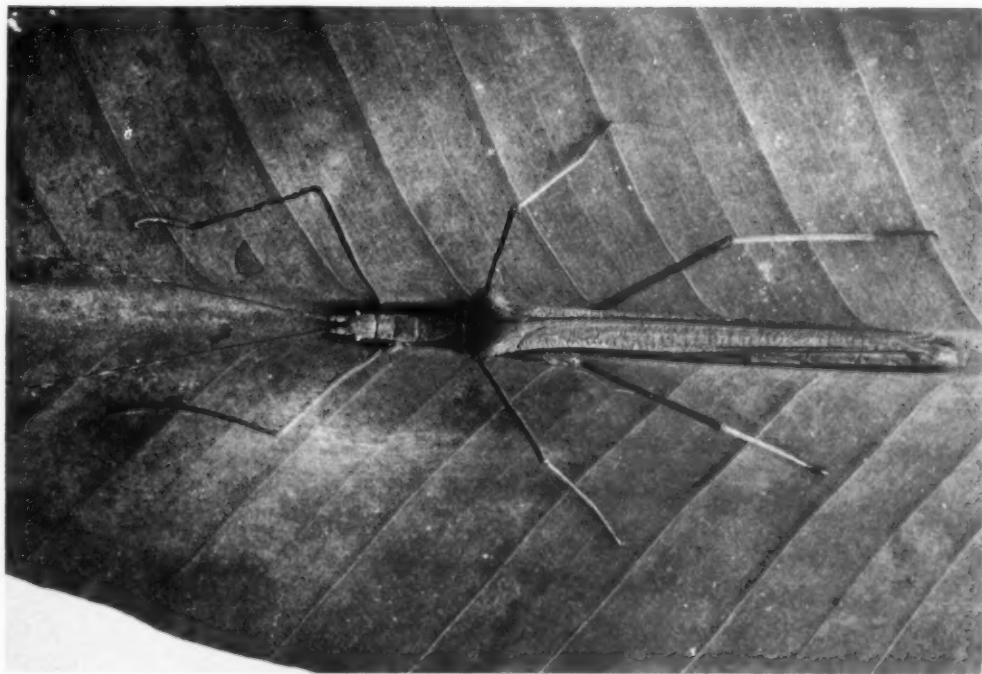
COCKROACHES MAY BE LARGE

This one is reproduced natural size and, like most of its relatives, lives out-of-doors, occurring rarely in dwellings



A "LONG-HORN" GRASSHOPPER

She carries her "ears" on her front legs and has antennae several times longer than her body. The "ear" on the right leg appears as a whitish spot on the inner surface of the front tibiae near the base



A "WALKING STICK"

It is always a matter of surprise to see what appears to be a part of the branch of a tree walking away. These insects feed upon foliage, and many of the adults are winged and quite good fliers

thrills of aërial travel, she has chartered a walking stick for her flight.

Probably the female midge takes only one flight. It seems likely that this occurs when she feels the need of reaching new ground where her numerous family can develop undisturbed by overpopulation and escape possible famine. In order to travel, she sinks her proboscis or mouth into the short wing covers of the walking stick. In this particular case (it may be only an exception) her mate (he was presumed to be such) had also fastened himself in the same manner. It is really a very interesting relationship. Of course the walking stick is an unwilling carrier of the family, but he is not inconvenienced in any way.

WHEN DEATH COMES

Death, in insect terms, lurks everywhere. Insects are born by the million, and it is safe to presume that they die in equal numbers. It is difficult to picture an insect dying from old age. If such a death is natural, it is at least rather unusual. If an insect escapes its predaceous enemies, there is still a possibility that disease will carry it off. There are

several fungus diseases peculiar to insects, and these are responsible for a goodly percentage of the insect death rate. At times the diseases reach the epidemic stage and then certain species may be all but wiped out.

Parasites attack almost all of the larger insects, and perhaps also most of the small ones. Caterpillars are occasionally observed struggling along on their dying legs, too weak, almost, to move, bearing on their backs several white cocoons of a hymenopterous parasite. As a rule the parasite does not reach maturity and emerge until the caterpillar is dead, but some of them do emerge before and leave the host free to continue feeding, although no adult butterfly or moth will later develop from the caterpillar. Parasitism is a study full of interest and teeming with remarkable relationships between host and parasite. Very little is known of this phase of entomology.

It is possible to discuss in one article but a very few of the great numbers of species of insects observed during two months spent on Barro Co'orado Island in the Panama Canal Zone.



A MOTHLIKE FULGORID

"Lantern flies" display a great diversity of form. This type is found on the under side of leaves, from which it sucks the juices



A BIT OF JAPAN IN MINIATURE

The Building of a Museum Group Showing a Japanese Country Home of the Middle Class—How Such Models Are Constructed

By V. ROXOR SHORT

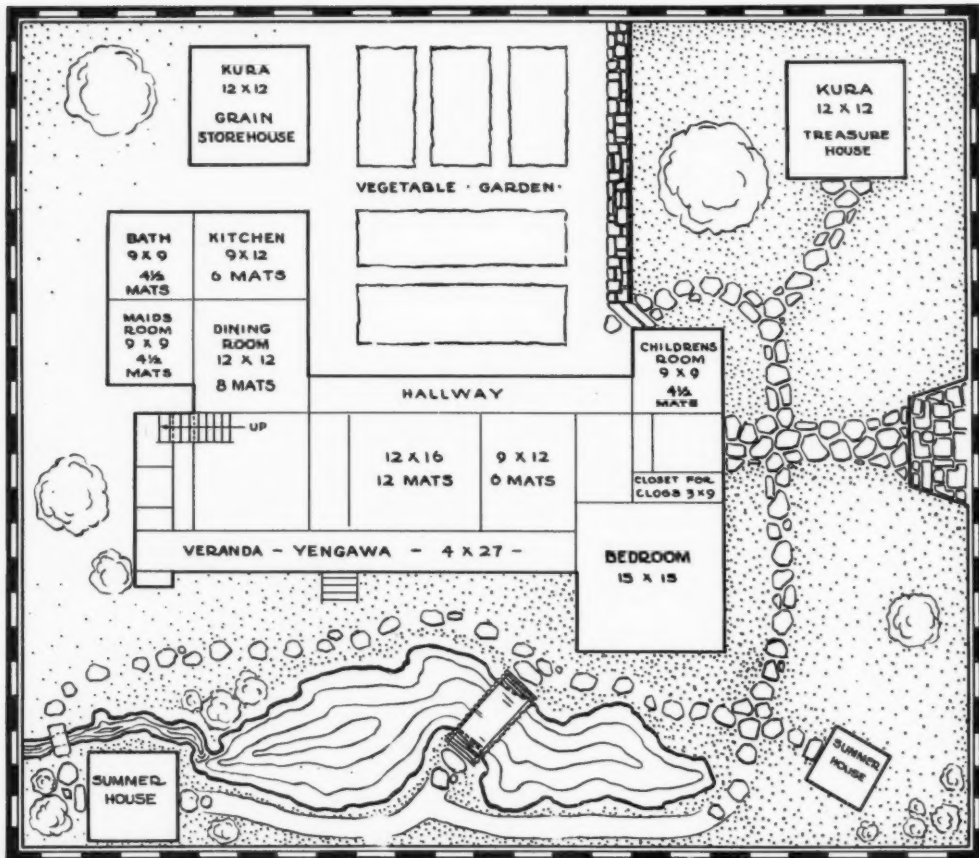
Department of Preparation, American Museum

IT is hardly practicable to present, in the halls of our museums, actual full scale exhibits of many of the objects that it is desirable to show, for large though the exhibition halls are, temples, tombs, and houses are often equally large, with the result that they must be shown in model form or not at all. Thus it is that almost every museum presents models of many objects, and remarkably accurate presentations can be made. With these visual aids, the visitor can re-create, almost perfectly, the original that is represented.

It has long been recognized as desirable by the department of ethnology of the American Museum that a model be constructed of a Japanese country home, for only by such means could the department readily explain the details of construction, and the plan and appearance of one of these thoroughly charming residences. The decision to build the model

having been made, I was fortunate enough to be assigned to the task of erecting it, and for more than six months have been engaged in building the house, laying out the garden, creating a tiny artificial pool, setting up trees, bushes, rock gardens, pergolas, fences, and all the other delicate features that go to make up this elfin home—all of which is built on the scale of one-half inch to the foot, with the result that the house and garden complete cover an area measuring only 48×53 inches.

As I have been working on the model I have been impressed by the number of people who have told me that they had imagined that Japanese houses were built of bamboo and paper. Paper, of course, is used only in screens, and takes the place of our glass in order that light may be admitted; and bamboo, while often used in making furniture, is extensively used



THE PRELIMINARY SKETCH

With this sketch as a beginning, and with innumerable sources of information upon which to rely, the group was begun

as lathing and under-surface structure.

Naturally, when confronted with the task of erecting this model, my first activities had to do with gathering all the available information concerning the attitude of individual Japanese toward their homes. Thus armed with a point of view which among Japanese is fairly constant, I began to study very carefully the details of construction. Sound reasons underlie all the structural intricacies of Japanese architecture, and many formulæ enter into their designs and plans.

After studying several Japanese architectural drawings, I started out with a preliminary sketch for our model, and almost before a plan was decided upon, I

found a minor difficulty in the measurements we had to use.

In Japan the *shaki* is a unit of linear measurement, and fortunately it is equivalent to our foot. It is, however, divided into tenths instead of twelfths, so all of our figures had to be converted into *shakis* and parts of *shakis* called *suns*.

The frame of the house is constructed of cedar, with each individual board and timber cut accurately to scale. By these careful means construction was pushed forward slowly and accurately, measuring and verifying until the siding was in place and the delicate joists of the roof were erected, ready to support the thick layer of grass thatch.



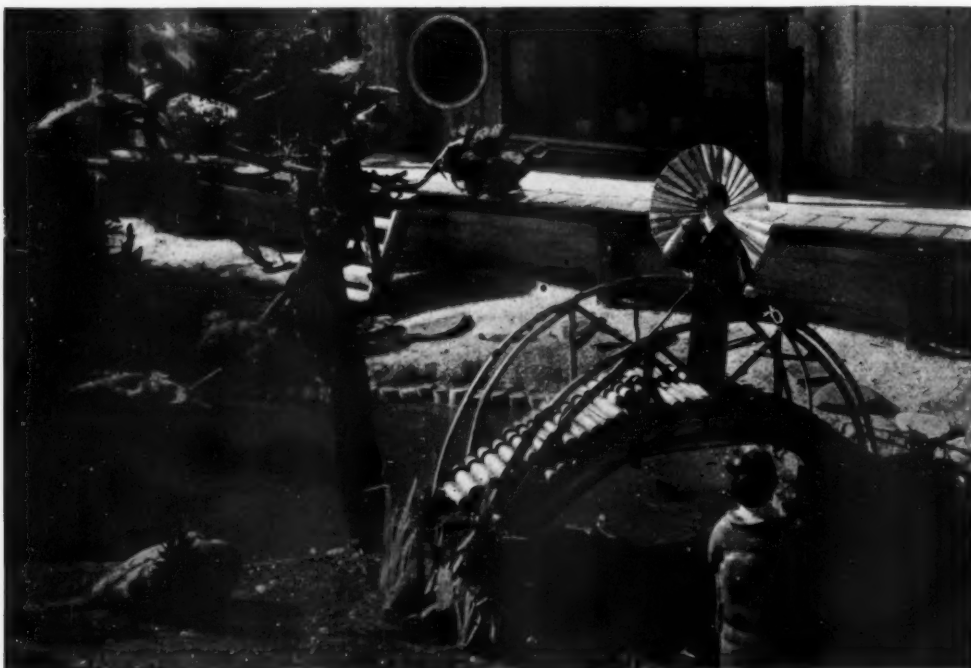
THE MAIN ENTRYWAY

It is difficult to believe, from the picture, that the house shown here measures only 6 inches from the ground to the eaves. Even the shrubbery has been so chosen as to suggest the same proportions as the house



FROM THE WISTARIA ARBOR

Showing the garden pool and the house. In the pool, over which the bridge passes, very tiny real fish, infiltrated with paraffin, give the impression of life



A GUEST VIEWS THE GARDEN

The little lady on the bridge, made of wax and standing only two and a half inches high, may be intent on the arrested activities of a real, paraffin-infiltrated frog, which sits on a wax lily pad on the glass of the garden pool



THE GARDEN FRONT OF THE HOUSE

Looking across the pool, one sees into the guest room, which has been opened to the garden by sliding the wall screens aside. Within, tea is being served to the guests of the house



THE WISTARIA ARBOR AND THE GATE

In the background is the *kura* or fireproof storehouse for the treasures of the family. The boy standing near the gate has unfortunately entangled his kite among the branches of a tree from which he is never likely to recover it



AN "AIRPLANE" VIEW

Looking down on the house and the garden, one sees two square yards of miniature Japanese countryside, representing about one quarter of an acre. The incomplete portion of the roof has been left to show the construction of the house

Boards, of course, could be cut and trimmed to scale, but the problem of obtaining something to imitate the thatch used in Japan, and of having it, too, to scale, was less easy. Furthermore, it was during the month of May that this thatch was required, and for a time it seemed as if Nature had nothing to offer us. Finally, however, on a collecting trip that led us fifty miles out on Long Island, we found a bed of dried pine needles in the midst of a delightful pine forest. Carefully selected, these dried pine needles served our purpose admirably, and seem an almost perfect thatch for a house built on the scale of one-half inch to the foot.

Another task lay in the selection of stones for rock gardens, walls, and walks. The result was that we spent hours along the Long Island shore picking pebbles

with the utmost care in order to choose only those that seemed to have, on a small scale, the characteristics that one would find in such rocks in a full-size garden. Endless hours were spent collecting odd stones, twigs, tiny bushes, and unusual plants, which would lend themselves to the scheme of things on that ever-present scale of one-half inch to a foot.

After laying and trimming the thatch, we turned our attention to the construction of tiny tiles for those portions of the roof on which thatch was not used. The roof of the *yen-gawa*, or verandah, alone required more than 600 individual tiles, each less than half an inch square.

For the *shoji*, or screens, we had the good fortune to obtain some real Japanese *shoji* paper, and the screens themselves are so constructed as to slide on tracks as

they do in a real Japanese house. The wooden storm doors, too, and the gates, are swung so as to be movable.

The house had progressed considerably before much detail work was done on the garden, and the *kura*, or fireproof warehouses, were constructed. Sometimes, in the more decorative *kura*, the art treasures of the establishment are kept, for Japanese houses are readily destroyed by fire. In other simpler *kura* rice and other grains are stored. The walls of these structures are heavily built of mud and plaster, and the vaultlike doors were reproduced in the lightest of wood—balsa.

One of the difficult problems in the garden was the construction of an elm tree, which was finally made of wax, for there are no shrubs that take a shape that is satisfactorily elm-like. The leaves of the elm tree were made of oatmeal carefully colored green.

About the most difficult illusion to

develop on a small scale—or a large one either, for that matter—is the illusion of water. It is generally either stiff or badly colored, and the methods that are adaptable to a large scale do not lend themselves to manipulation to the scale on which this Japanese garden is built. Consequently, a piece of fine plate glass was flowed with a layer of liquid cellulose and delicately colored to give the soft variation of hue that is found in a quiet pond or pool. Careful scrutiny will divulge several *real* fish, not alive, it is true, but preserved, in the pond; and comfortably established on a neighboring lotus pad is a frog—also an actual preserved specimen.

If one were able to dwindle in size, as did Alice in Wonderland, and were then introduced to this Japanese garden, one would have attained the ideal viewpoint necessary to a model builder. One might then follow the stone-flagged path and tell



“MOONLIGHT” IN JAPAN

The completed group will be shown in its case as if in broad daylight. The photographer, however, was able, with the careful use of electric lights, to get this moonlight effect

in an instant if the wax vegetables and the berry bushes were ever so slightly out of scale.

In order to add to the illusion, and to show more clearly the relative size of the house and its occupants, several figures appear in the garden. A Japanese lady with a parasol stands on the tiny bridge over the garden pool, her costume showing, by its symbols, her station in life and the family of which she is a member. Japanese kimonos usually carry the insignia or coat of arms of the family on the sleeves or in the middle of the back, and this wee garment is no exception to the rule. The lady's method of doing her hair explains her position in matrimony and there are many other such symbols woven into the model. A boy is trying to extricate his kite from among the oatmeal leaves of the waxen elm tree where I

entangled it in an effort to create a bit of "human interest," and the preserved fish in the pool, after the manner of live fish, pay no attention to what is going on in the airy garden about them.

It is by such methods that the department of preparation of the American Museum attempts to depict those distant objects that cannot be brought bodily into the Museum, and even if, as in this case, the "thatch" is of pine needles, the figures are of wax, the water is made of glass, the leaves are made of oatmeal, and the grass is represented by finely clipped silk, the illusion is convincing.

The accompanying illustrations were made by Irving Dutcher of the American Museum photographic department, and present a series of pictures that tell with great accuracy the story of a home in the Land of the Rising Sun.



MR. SHORT COMPLETING THE MODEL

The scale on which this bit of Japan has been built is here shown plainly

HOW ATOMS BUILD

A Proof that Simplicity and Not Complexity Lies at the Base of Crystal Structure

By HERBERT P. WHITLOCK

Curator of Minerals and Gems, American Museum of Natural History

IT has been said that the deeper we penetrate into the knowledge of natural processes the wider is the vista of the unknown that opens up before us. The theory that fifty years ago was hailed as a veritable outpost of scientific achievement, has today become a part of a larger, fuller, more far-reaching theory. And as we travel this road of knowledge we are beginning vaguely to grasp the rhythm, order, and continuity of these processes of nature. Gradually there emerges from what formerly seemed unrelated facts and phenomena, basic principles of great and supremely beautiful simplicity. We become fundamentalists in science searching always for the key note of simplicity, the deep basic tone that makes for harmony in the scheme of material things.

Such a fundamentalist in science was Rene Just Haüy, who, amid the appalling circumstances of the French Revolution, sat calmly in his Paris prison, surrounded by his little collection of mineral specimens, and evolved the great law of symmetry that is the basis of the science of crystallography.

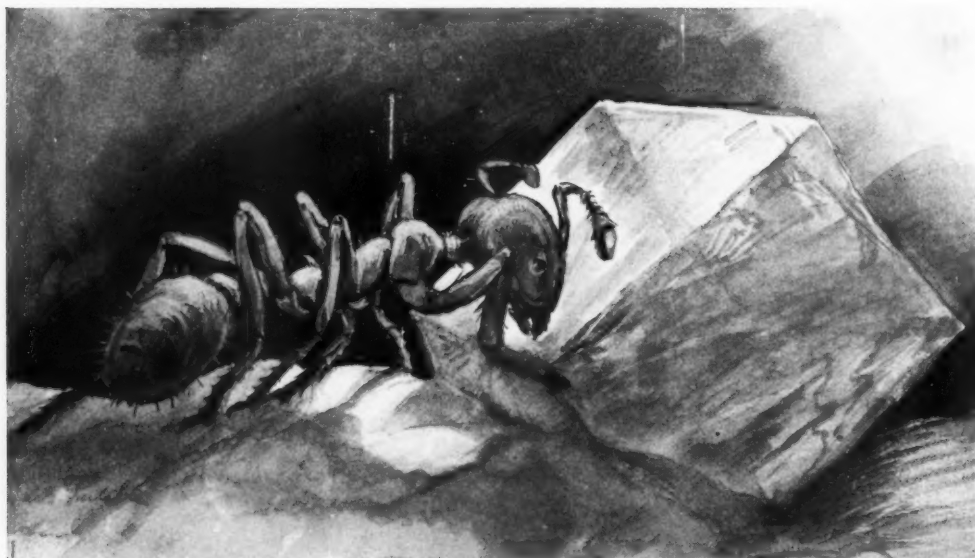
Such fundamentalists, no less, were the little group of workers, Laue, Debye, Scherrer, and the Braggs, father and son, who, a century later, used the short waves characteristic of the X ray to demonstrate how the atoms composing crystalline bodies are grouped in symmetrical three-dimensional patterns, thus giving us a far-reaching and definite reason for the outward harmony of symmetry that was Haüy's contribution to our store of knowledge. Today the physicist and the crystallographer, working with

these tools of modern science, can map the relative position of the atoms in crystalline substances with as much certainty as the physical astronomer can name the elements that compose a distant star.

This relatively new field of investigation is known as crystal structure. Its units are almost immeasurably small; so small, in fact, as to be far beyond the limit of vision of our most powerful microscopes; and in dealing with them we do not attempt to assign to them the attributes of size and shape. What we do know, thanks to the special properties of the X ray, is the relative distances between them. Even these distances are exceedingly small, and we are obliged to resort to minus exponents of high value and to somewhat fantastic comparisons to convey an adequate idea of the minuteness of these atomic distances.

For instance, let us assume a fragment of crystallized common salt no larger than the head of a pin. In order to represent the spacing between the sodium and chlorine atoms of this tiny chip of crystallized matter, in such a manner as we have used in the model shown in Fig. 6, we would have to magnify it to a mighty mountain of salt whose base would extend about twenty-five miles and whose summit would tower far above the highest clouds. Is it then at all remarkable that crystals in the perfection of their development should present to our eye the brilliant smooth surfaces that are the bounding planes of their countless myriads of atomic units?

Let us consider the plan upon which some of these atomic edifices are reared, atom next to atom, like bricks in a tre-



Drawing by Mrs. E. R. Fulda

A GRAIN OF SALT

Fig. 1.—A grain of rock salt so small that even an ant can carry it, contains many millions of atoms

mendous wall which by some transcendent magic has become small enough to be encased in a nut shell.

No doubt many of us have noticed that when we attempt to crowd together a number of objects of similar size, such as peas, golf balls, or oranges, they inevitably form groups of three, and that these groups of three are linked together until the layer of objects makes a pattern, like that pictured in Fig. 3. If we were to add to the first layer of balls such as we have used in Fig. 3, another layer piled upon it and still another piled upon that, the assemblage of balls would look like Fig. 4. This arrangement of particles of matter, no matter what their size, has been called "close packing" because by this method the greatest number of particles are made to occupy a given space. It is therefore the simplest and the most obvious of particle grouping.

Research with the X ray has shown us that the atoms of many of the metals such as gold, silver, copper, lead, nickel, aluminum, calcium, iron, and platinum are grouped in this way, so that we are

confronted with the very significant fact that a number of simple substances (the above metallic elements) form in crystals, the atomic structure of which consists of the simplest particle grouping.

Let us study the close-packed grouping of Fig. 4. If we were to consider the uppermost ball of the pyramid as the corner of a cube and complete the cube by the addition of four more balls as in Fig. 5, we would find that the added balls (representing atoms) have only extended the close-packed grouping, and that Fig. 5 is only another expression of close packing. It is in some ways more convenient and illuminating to consider the aspect of close packing shown in Fig. 5 (which is called a face-centered cube) as our starting point, although we should by no means lose sight of the very significant triangular aspect of Fig. 4, because it emphasizes the group of four atoms arranged at the angles of a tetrahedron (compare the four topmost balls of Fig. 4).

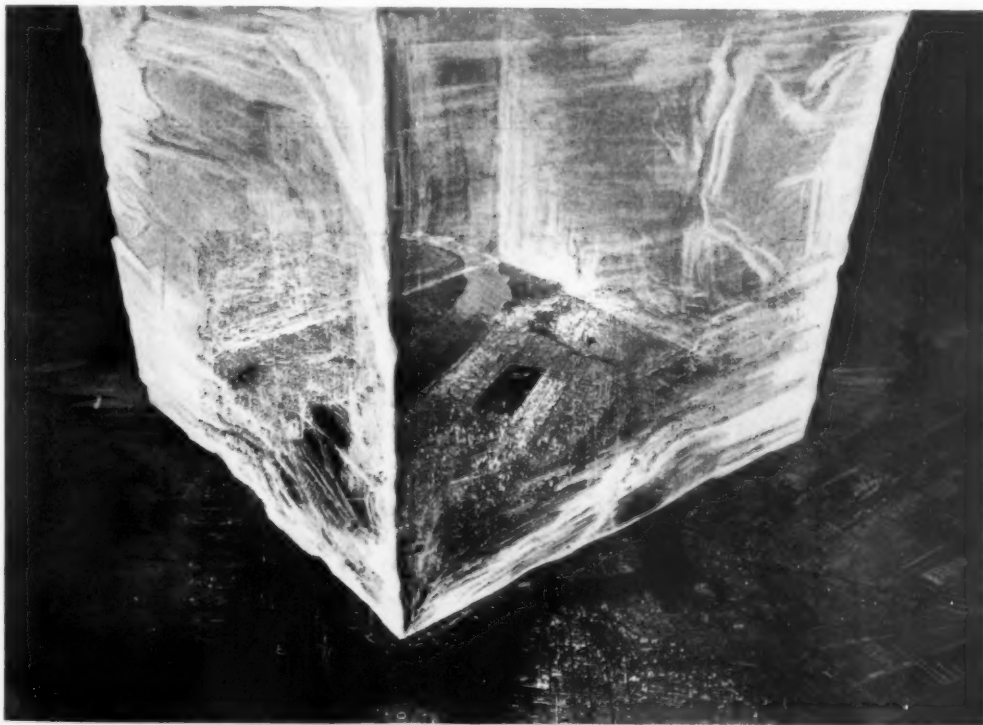
If we were to suppose the close-packed grouping to consist of alternate layers of *two different kinds of atoms* as in Fig. 6,

and if we were to suppose the atoms represented in the model to be those of sodium and chlorine, the resulting grouping would show the atomic structure which the X ray has revealed to be that of sodium chloride or common salt. Notice how the smaller balls representing the chlorine atoms, which have a smaller *atomic domain* than those of sodium, fit into the open spaces between the larger balls representing the larger atomic domain of sodium atoms. Both sodium and chlorine atoms as represented in the model (Fig. 6) are in face-centered cubic arrangement, and in an extension of the grouping there would be as many of the one kind of atoms as of the other.

Also note that the planes of atomic crowding are parallel to the face-centered cubes of both aggregates of atoms, ex-

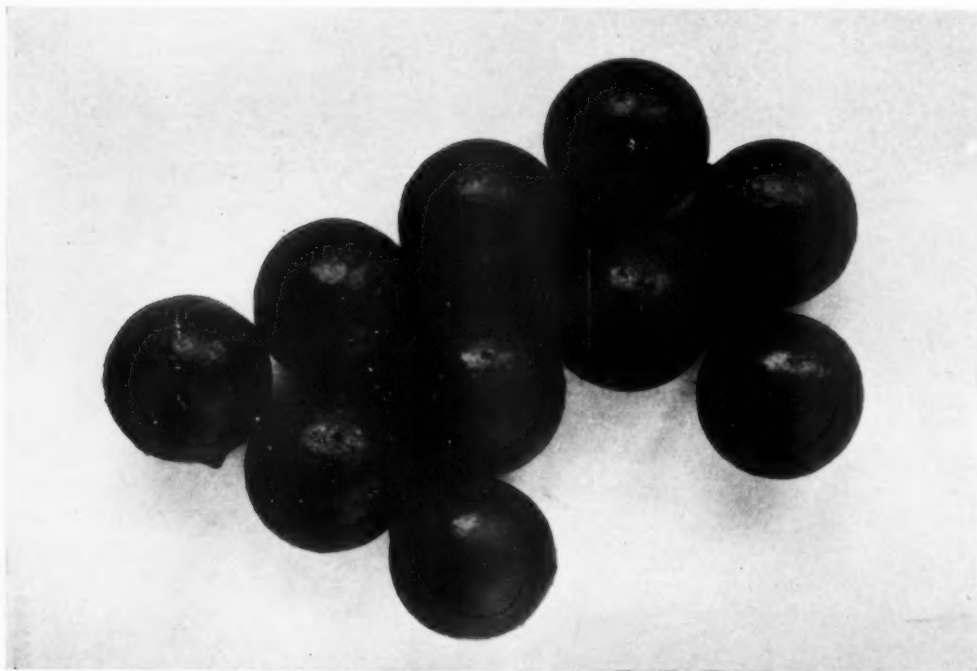
plaining why sodium chloride crystals show a marked tendency to break parallel to cube planes. And finally note that the relation between the two face-centered groupings of sodium and chlorine atoms is that of two tetrahedrons, one reversed on the other, as shown in Fig. 8. Among the crystallized substances whose atomic structures are at present known, a considerable proportion have structures of the sodium chloride type.

Let us now suppose that two kinds of atoms are separately spaced in close-packed (or face-centered cubic) grouping, and that these two groupings or sets of atoms are so interlocked that the corner atom of the tetrahedral cell of the one grouping falls in the *center* of the tetrahedral cell of the other grouping. The relation of the tetrahedral cells in such an



A COMPARISON

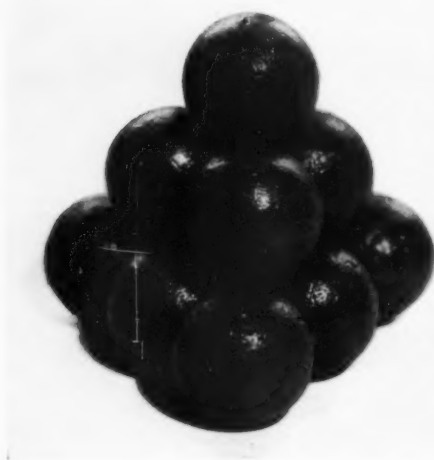
Fig. 2.—If we were to try to magnify the fragment of common salt that the ant is carrying in the preceding picture until we could distinguish the atoms that compose it, we would have to enlarge it until its huge size would completely cover Greater New York and tower up above the clouds



CORK BALLS IN CLOSE-PACKED ARRANGEMENT

Fig. 3.—Whenever a number of objects of similar size are crowded together, they inevitably form groups of three, which when linked together, form a pattern such as is pictured here

atomic structure is pictured in the model shown in Fig. 7, in which the positions of the atoms at the angles of the tetrahedra



A CLOSE-PACKED PYRAMID

Fig. 4.—When the units are fastened together, the pyramid will appear the same, no matter on which one of its four sides it may rest

are not shown. Such a structure composed of zinc and sulphur atoms has been found to be characteristic of the mineral sphalerite, a zinc sulphide, in which every zinc atom lies at the center of a tetrahedral group of the sulphur atoms, and every sulphur atom at the center of a similar cell formed of zinc atoms. The model shown in Fig. 9 will help to make clear the intricate relations of a crystal structure of this type. In this model the larger balls represent the zinc atoms with the larger atomic domain, and the smaller ones represent the sulphur atoms.

Although not so frequently met with among those crystals which have been studied, as the atomic structure of the sodium chloride type, groupings of the zinc sulphide type are nevertheless characteristic of a number of substances. The carbon atoms in a diamond crystal are spaced in this manner, except that in this instance all of the atoms are of one

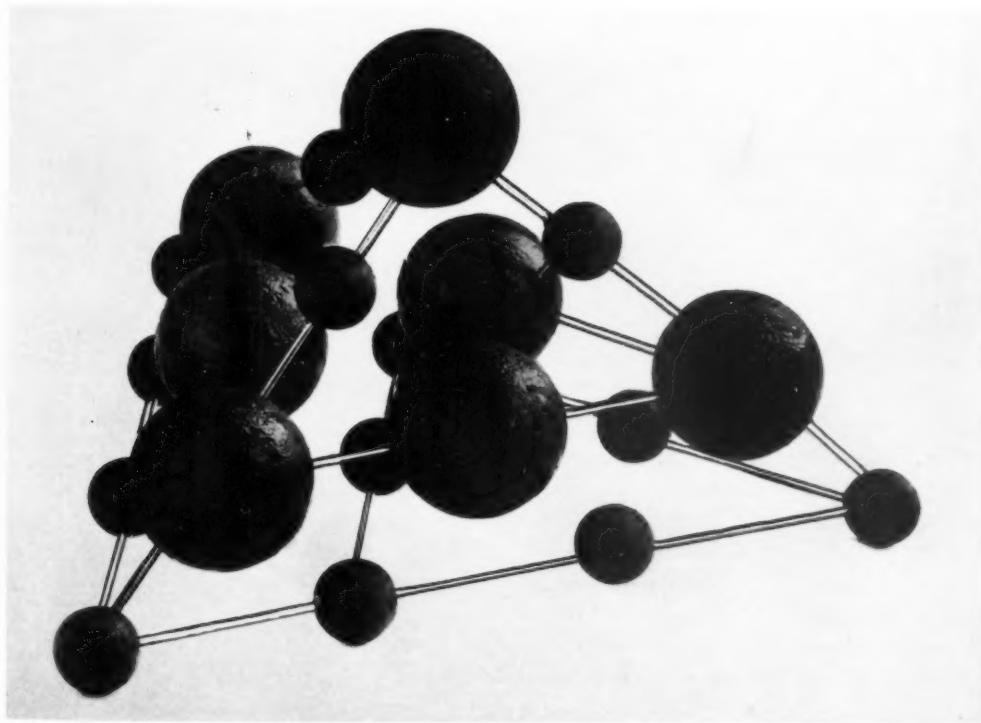
element, and a single tetrahedral cell would appear as the model shown in Fig. 10A, or assembling several such cells in the atomic grouping of diamond, we have the model shown in Fig. 10B. It is very obvious from this aspect of the diamond atomic structure that the carbon atoms are firmly linked together in a pattern that is highly resistant to physical deformation. We would therefore expect such a crystal structure to be very hard. It does, in fact, belong to the hardest substance known.

There is, as we all know, another kind of crystallized carbon, the mineral graphite. Now investigation has shown that the crystal structure of graphite differs from that of diamond in a relatively slight particular from a mechanical point of view. Observing Fig. 10 closely,



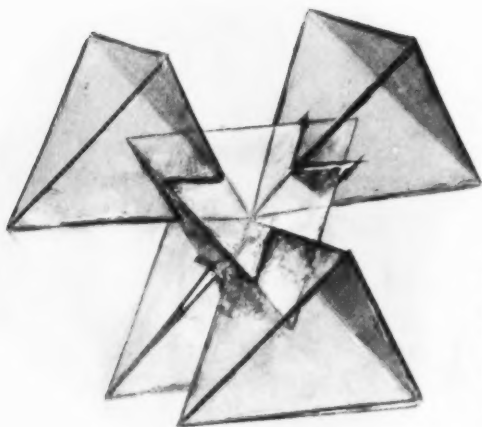
A "FACE-CENTERED CUBE"

Fig. 5.—The close-packed arrangement of cork balls in this model is the same as that of Figure 4. If the lowest ball, the upper right one, and the upper left one were removed, we would see the arrangement of Figure 4



ATOMS IN A CRYSTAL OF SALT

Fig. 6.—The arrangement of the atoms in a crystal of common salt is represented in this model. It is a close-packed grouping like Figure 4, spread apart so as to show the relative position of the atoms. The large balls represent sodium atoms, the smaller ones chlorine atoms

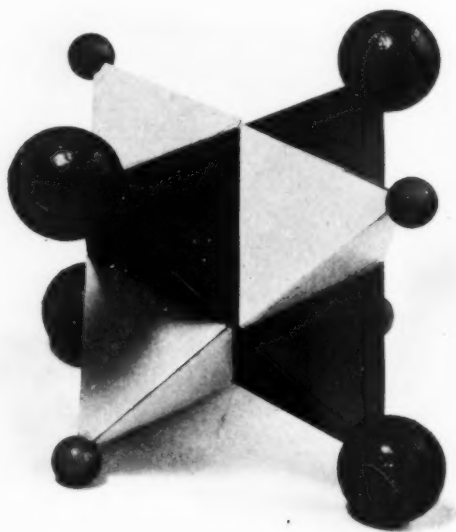


INTERLOCKED CELLS OF ZINC SULPHIDE

Fig. 7.—The balls representing the atoms in this model of the interlocked cells of zinc sulphide have been omitted. There should be one ball at the four points of every tetrahedron, placing an atom of zinc in the center of every group of four sulphur atoms and an atom of sulphur at the center of every such group of zinc atoms

we find that we may consider the atoms as lying in layers, upon one of which the model rests, as shown in the illustration. Imagine the second layer of atoms from the bottom to be slightly shifted (one sixth of a circle) until it "clicked" into place, and at the same time was drawn away slightly from the lower layer. The result of this slight mechanical shift will be seen in the model shown in Fig. 11, which represents the position of the carbon atoms in graphite. This crystal structure has not the symmetry of the diamond pattern; the close bond that tied together the atoms of that remarkable substance is gone, and in its place we find open spaces between successive layers of atoms, suggesting the possibility of the layers slipping one upon the other. Graphite is soft and greasy or slippery to the sense of touch.

Hitherto we have been considering the crystal structure of such minerals as common salt, sphalerite, and diamond, all of which crystallize in the isometric system, and the atomic groupings involved have consequently all presented the perfect symmetry of that system; they have all (with the exception of graphite) shown us a three-fold arrangement of atoms when viewed from the direction of the corners of a face-centered cube. Let us now turn back to the consideration of Fig. 4 and assume that the close-piled aggregate of material particles are pressed together along *one* three-fold axis, or drawn apart in the same direction. Such conditions produce atomic structures that no longer show isometric symmetry, but which present the symmetry of rhombohedral crystals, that is *one* axis of three-fold symmetry. If we were to assume the sodium chloride grouping of Fig. 6 to be



THE ATOMS OF A SINGLE "CELL"

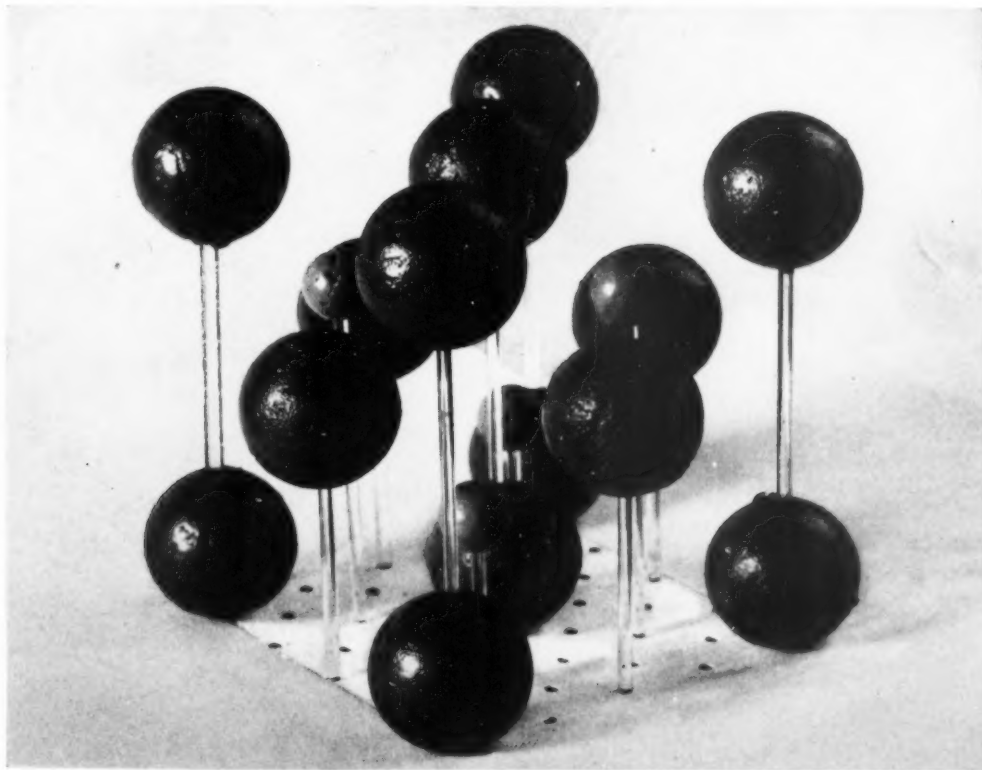
Fig. 8.—The eight balls forming the top corner of Figure 6 are arranged as in this model, which by separating them from the others and linking them in fours shows how the atoms of a "cell" of a crystal of common salt are related

so compressed, say in a vertical direction, our model would bear a close resemblance to the structure of a common rhombohedral mineral, calcite.

Calcite is composed of the atoms of three elements, calcium, carbon, and oxygen. There are in its composition as many atoms of carbon as there are of calcium, and three times as many oxygen atoms as there are of either calcium or carbon. X ray research has shown us that the oxygen atoms are grouped in clusters of three around every carbon atom, and that the atoms of calcium and of carbon are grouped as those of sodium and chlorine are in rock salt, except that the entire atomic aggregate has been slightly compressed in one trigonal direc-

tion. The model shown in Fig. 12 represents the arrangements of atoms in a crystal of calcite. The largest balls represent calcium atoms; the black ones spaced alternately with them represent the carbon atoms; and the smallest balls grouped in threes about the carbon atoms are those of oxygen. Just as the cleavage of rock salt is cubic, the cleavage of calcite for a similar reason is rhombohedral.

The few examples with which we have dealt in the foregoing pages constitute only an introduction into the bewilderingly fascinating field that has been opened up by this "new crystallography." For instance, no attempt has been made to show how the structure of crystals in systems other than the isometric and the



ATOMS IN A CRYSTAL OF ZINC SULPHIDE

Fig. 9.—A model showing the arrangement of atoms in a crystal of zinc sulphide. The face-centered cube grouping of the larger units (representing zinc atoms) is quite obvious. The smaller units (representing sulphur atoms) are also on a face-centered cubic pattern

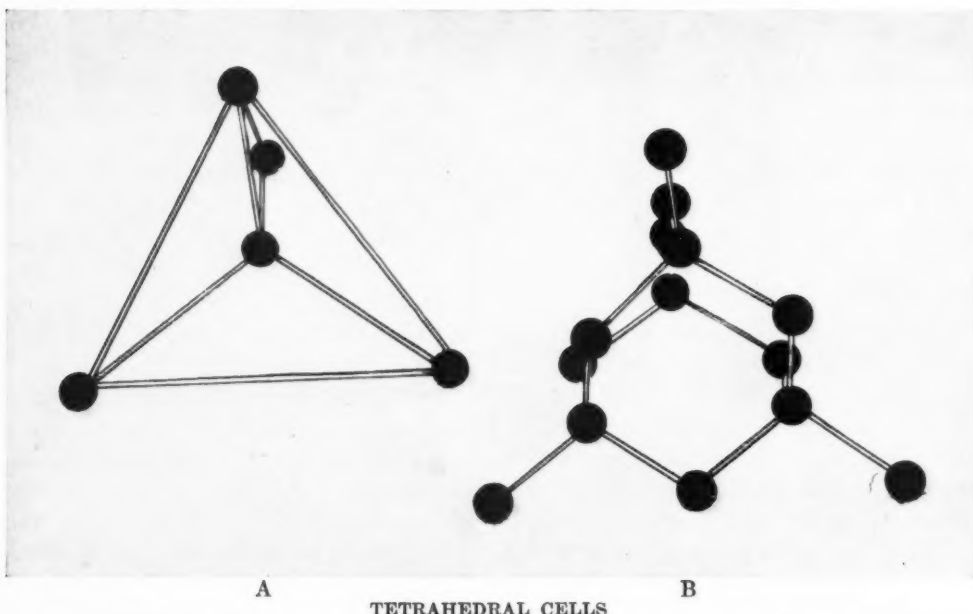
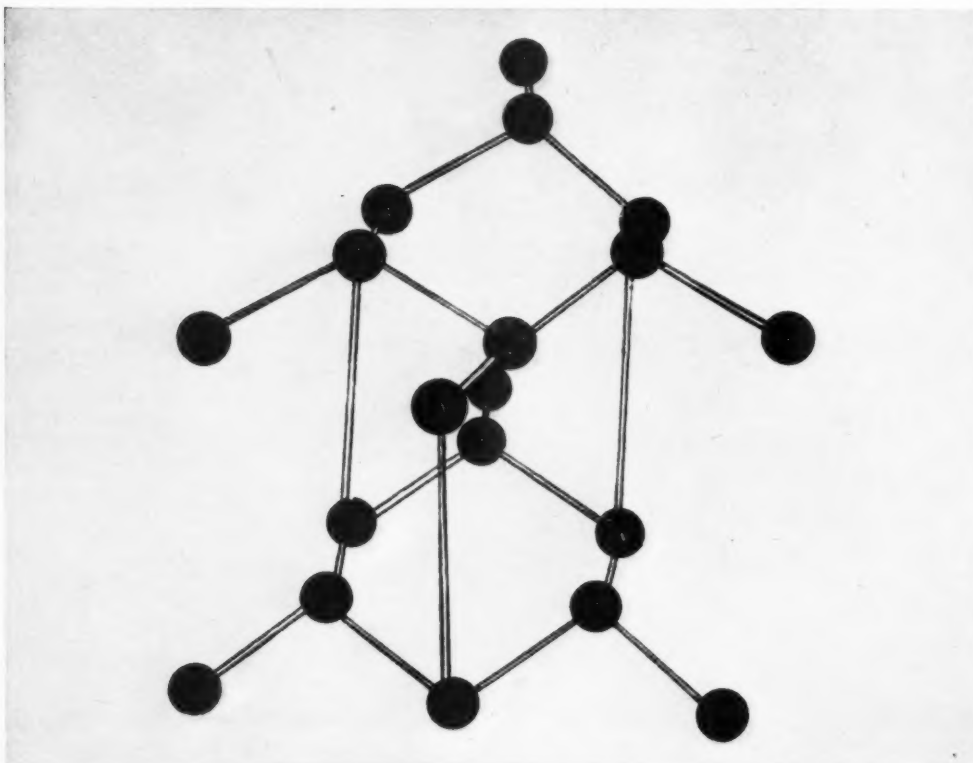


Fig. 10.—“A” shows a single tetrahedral cell formed by the carbon atoms of a diamond crystal, and “B” shows a number of such cells linked together as in the atomic structure of diamond



ATOMS IN A CRYSTAL OF GRAPHITE

Fig. 11.—A model showing carbon atoms arranged as in a crystal of graphite. The six balls upon which this model rests are in the same position as the six upon which that shown in Fig. 10B rests

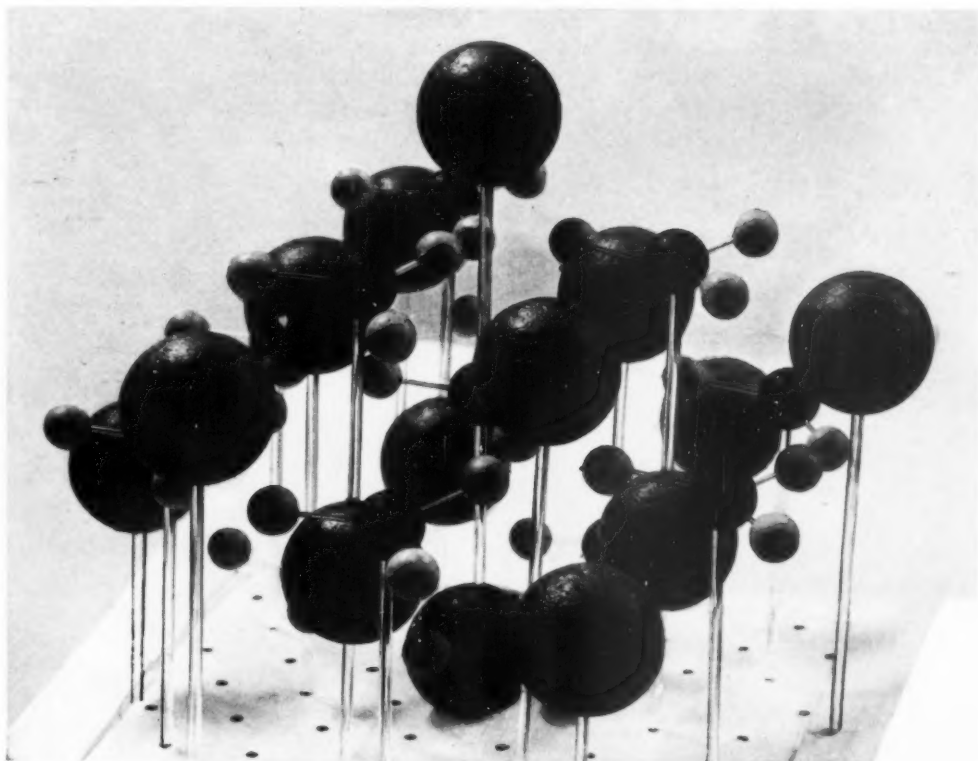
rhombohedral are derived from the close-piling principle, although such a demonstration would have been quite simple and along the theoretical lines made classical by Bravais and others.

The new demonstration of crystal structure has been responsible for the elimination of some of the time-honored concepts of mathematical crystallography. We have found, for instance, that rhombohedral crystals, like calcite and quartz, that have heretofore been classed with the hexagonal system, are structurally more nearly allied to isometric atomic groupings, and should therefore belong to a distinctly separate system. Also the old concept of hemihedrism in crystals becomes structurally unfounded, however

much it may add to convenience in treating them mathematically, and when we consider the atomic structure of sphalerite.

In general, the work that is now being energetically pursued in countless laboratories throughout the world by investigators who are using the X ray to determine crystal structure, has shown that simplicity and not complexity lies at the base of this great problem.

The examples we have taken to show how directly in very many instances crystal structure has at its foundation the close-piling principle, are not exceptions but standard types. It would then seem that here we have another comprehensive law reaching down to the very roots of material things.



ATOMS COMPOSING CALCITE

Fig. 12.—The atoms composing calcite, represented in relative position by the cork balls of this model, are of three kinds. The large balls represent the atoms of calcium, the black balls those of carbon, and the white balls, grouped in threes about the black ones, atoms of oxygen



Photograph by Mary L. Jobe Akeley

Mount Karisimbi in fresh snow

AFRICA'S GREAT NATIONAL PARK

Carl Akeley's Gorilla Sanctuary and Biological Survey Station
Becomes a Reality—The Formal Inauguration of
the Parc National Albert at Brussels

By MARY L. JOBE AKELEY

On October 19, 1929, the Belgian Government officially opened the Parc National Albert, in the Belgian Congo, the plan for which originated with Carl Akeley of the American Museum. The following article, by the wife of this explorer and naturalist, tells in detail of the development of this important step in the conservation of African wild life.—THE EDITORS.

IN January, 1922, while homeward bound on the Red Sea, from his gorilla expedition in the Belgian Congo, Mr. Akeley's idea of a gorilla sanctuary took definite shape. He wrote to Judge Paul Salkin, Elisabethville, Katanga, Belgian Congo, that he had found the gorilla "a wholly acceptable citizen and not the wicked villain of popular belief"; that he is "a splendid animal in every sense, in no sense aggressive or inclined to look for trouble."

He also said that the largest male, a magnificent creature weighing 380 pounds, like all the others secured by the expedition, showed only a disposition to get out of danger. He stated that he was

communicating with the authorities at Brussels in regard to establishing a sanctuary for the gorillas of the Kivu country where they may have protection for all time. He then added: "If this is not done very soon, they are in positive danger of being exterminated. I do not think it is fair to future generations to exterminate an animal of such intense human interest as the gorilla. He is harmless; the natives of the region have no fear of him and he in no way interferes with them. He occupies a region that will never be available for agriculture or other human uses more than to supply forest products such as bamboo and fire wood, and the native privileges need not be curtailed by con-

verting a great tract of primitive country into a gorilla reserve. I not only want to establish a sanctuary, but also a biological survey station, where students of animal psychology and kindred subjects may carry on their research work under most advantageous conditions."

On January 18, 1923, Mr. Akeley compiled various suggestions regarding the establishing of a sanctuary for the gorillas, and submitted these to his esteemed friend, Dr. John C. Merriam, of the Carnegie Institution, Washington, dean of ardent conservationists and promoter of scientific research. He called attention to the fact that the number of gorillas in the Kivu region is small, which seems strange since, so far as we know, they have no enemy but man and the natives do not molest them; that they are healthy; that they are not wild, as was shown when three of them ran onto a leaning tree 150 feet away to get a better look at

him and were apparently unconcerned, though he was in full view operating a motion-picture camera. He recalled the fact that even with one of their number shot, they moved away only a short distance where they were easily approached again, and he stated that obviously it would be a very easy matter to exterminate this colony.

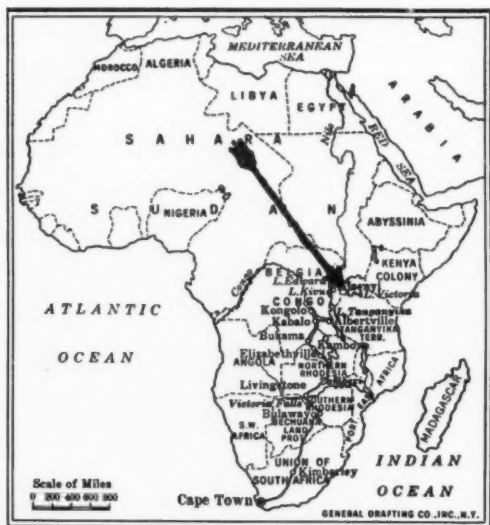
He suggested setting aside as an absolute sanctuary an area approximately ten miles square, where, when undisturbed, the gorillas would soon have complete confidence in man and would doubtless afford opportunity for observation and study at close range; and also that the area should be bounded by a native-police-patrolled roadway, a "dead line," within which the "gorillas would soon learn that they were safe, and beyond it in danger" and that there would be "no difficulty in keeping them within the sanctuary unless it became over-populated."



Photograph by Mary L. Jobs Akeley

THE PRIMITIVE FORESTS OF THE PARC NATIONAL ALBERT

This shows a section of the Rugeshi or Cold Forest on the slope of Mount Karisimbi



Map showing location of the Gorilla Sanctuary

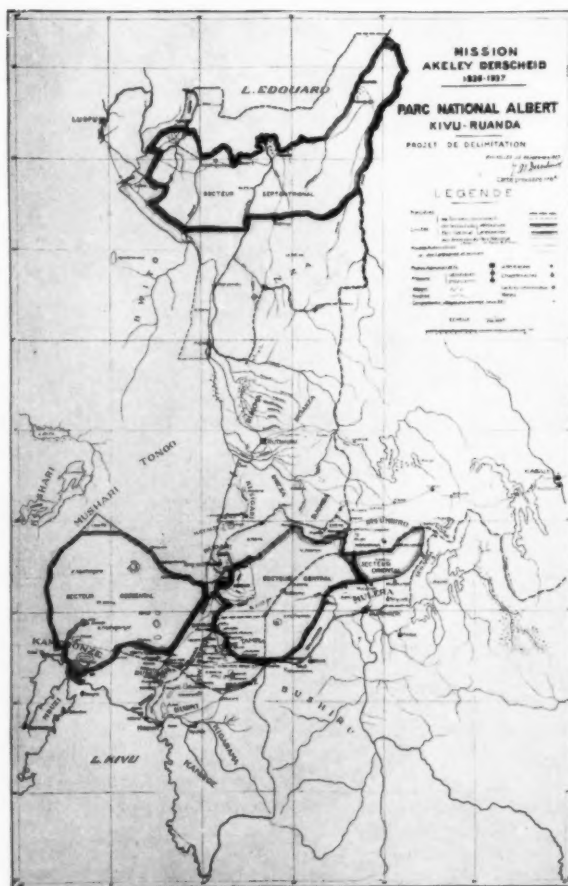
"In coöperation with the Belgian Government," he wrote, "it is my desire to see an organization established which shall undertake to make provision for its care and maintenance; to establish and maintain a scientific research station with residence and laboratory facilities located at an altitude of approximately six thousand feet where the climate is suitable for the continued residence of Europeans. One resident white superintendent would be required to be in charge of the station and to oversee the patrol and maintenance. I wish to emphasize the importance of making this region an *absolute sanctuary*! Sanctuary is not sanctuary unless *absolute*."

Doctor Merriam immediately turned over this statement with his strong recommendation of the

Map showing the enlarged area of the Parc National Albert as established by Royal Decree of Albert, King of the Belgians, May 6, 1929, and suggested by the Akeley-Derscheid Mission of 1926

gorilla sanctuary plan to Baron Emile de Cartier de Marchienne, then Belgian Ambassador to the United States. Doctor Merriam also submitted a statement covering the organization, history, and method of establishing the national parks, monuments, and bird refuges in America. Several months before, Mr. Akeley had interested the Belgian Ambassador in the results of the gorilla expedition and the plan of conservation. Accordingly, early in 1924, the Ambassador began active efforts with his home government to the end that not only the small area of the reservation be secured, but that a larger outlying tract of land be set aside as additional protection to the gorilla.

Seconding the efforts of Baron de Cartier with unremitting devotion, was





Photograph by Carl Akeley

A GROUP OF KIVU PYGMIES

The pygmy, doubtless the earliest of primitive peoples in the Kivu forest, dwells in the lower reaches of the volcanoes. The mature pygmy is approximately four and a half feet in height, and looks like a ten-year old child in contrast with the native Wahutu, who is only average height

the Belgian Consul-General at Baltimore, Mr. James Gustavus Whiteley, whose helpful interest for more than twenty years had furthered the scientific expeditions sent to the Congo by the American Museum of Natural History.

Among American organizations interested in the project were the Camp Fire Club of Michigan and the New York Zoological Society, both of whom in resolutions to Baron de Cartier expressed keen interest in the undertaking. The Department of the Interior of the United States also voiced its interest in a memorandum to the press.

On March 2, 1925, His Majesty, Albert, King of the Belgians, created by Royal Decree the Parc National Albert, Kivu District, Belgian Congo. A letter from His Excellency, Baron de Cartier, to Doctor Merriam, president of Carnegie Institution and vice-president of the National Academy of Sciences, supplies

the historical development of the Park at this point:

The advance of civilization into Central Africa has brought with it its inevitably attendant menace to primitive forms of wild life. This National Park has therefore been laid off, under the auspices of His Majesty King Albert, as a sanctuary where both animals and plants and natural scenery may be preserved and where scientists from all over the world may eventually come to study the flora and fauna of Africa in their original and natural surroundings.

During the past few years there has been an ever-increasing influx of big game hunters and natural scientists into the Belgian Colony which is the last refuge of many rare species of African fauna. The Belgian Government has recognized the necessity of permitting a certain number of such rare animals to be taken for scientific purposes, but has consistently endeavored to preserve these rare species and also to prevent the wanton destruction of other less rare, but harmless, animals, whose slaughter serves no useful purpose.

In these circumstances the Belgian Colonial Authorities have found it necessary to restrict not only private hunting expeditions but also similar expeditions contemplated by many of the



THE HEART OF THE PARC NATIONAL ALBERT—

This painting, by W. R. Leigh, was made under the direction of Carl Akeley, and is, in Mr. Akeley's own words, of "the most beautiful spot in the world"

most distinguished museums of natural history and other scientific bodies.

Among the rare animals which are in danger of extinction is the Gorilla—an animal of extreme interest to scientists. The Belgian Government has, in the past, felt it its duty to permit a few specimens to be killed or captured for strictly scientific purposes, but the time has come when, in the interests of humanity, as well as in the interests of Science itself, steps must be taken to preserve the remaining gorillas from extermination.

The reservation embraces the three volcanoes, Mt. Mikeno, Mt. Karisimbi and Mt. Bishoke.

In this Parc National Albert it is planned to erect a laboratory for biological studies where scientists from all parts of the world may eventually come and study the flora and fauna of the Belgian Congo as well as the geological and meteorological conditions.

In inaugurating this new experiment—the first of its kind in Central Africa—the King and his officials have studied the great American reservations and national parks and have sought the advice of eminent American scientists.

In order that the best results may be achieved it is hoped that this humanitarian and scientific

project may receive the sympathetic coöperation of the members of the National Academy of Sciences, and the benefit of their experience and wise counsel.

This letter was presented at the meeting of the National Academy of Sciences, in Washington on April 29, and a resolution was passed expressing the Academy's gratification at the establishment of the Albert National Park, and assuring His Majesty of its disposition to coöperate in the realization of the benefits to science and mankind arising from this wise and generous action.

Mr. Akeley's enthusiasm for the consummation of his dream and his appreciation of the action of His Majesty, the King, and the efforts of Baron de Cartier, are voiced in the following letter to the Belgian Ambassador:

May I offer to you hearty congratulations on the successful result of your work in connection with the campaign for the protection of the



THE SADDLE BETWEEN MOUNTS MIKENO AND KARISIMBI

In the distance, across the lava plains shown in these two pictures, may be seen the two active volcanoes, Nyiragongo and Nyamulagira. Lake Kivu lies at the extreme left

gorillas of the Kivu? May the Parc National Albert continue indefinitely to the honor of His Majesty, King Albert, and his Ministers, who have been instrumental in establishing this splendid wild life sanctuary.

Of course the killing of a reasonable number of specimens for scientific institutions is legitimate and necessary, but the indiscriminate killing by sportsmen and others is unpardonable. Killing gorillas cannot possibly be considered sport; the animals are easily located with the help of native guides in the regions they inhabit, easily approached, and easily killed. They are not wild in the sense that most hunted animals are wild.

They are not great wanderers. They are reluctant to leave the region in which they live, so it is possible, by following a band or a single animal, to come within shooting distance a number of times in one day.

Unfortunately there is a large class of men who for one reason or another, are constantly seeking excuses for killing. The gorilla, because of his unjust reputation for vicious ferocity, makes a strong appeal to the would-be hero type of sportsman, and the gorilla is menaced by the "white hunter" who would exploit him in catering to these "sportsmen" and for his own financial benefit.

It is possible that we "alarmists" who are interested in preventing the destruction of the gorilla have overstated our case and that there are more than one hundred gorillas in the forests of the three mountains now included in the Parc National Albert. *I hope there are more than one hundred*, but I doubt it. The point of paramount importance is that we "play safe," and that is the thing that is accomplished through the establishment of the Parc National Albert. If in the future it is found that there are, for any reason, too many gorillas, it will be very simple to reduce their numbers; while, on the other hand, if we were some day suddenly brought face to face with the fact that the last gorilla had been killed, it would be a very different story.

In reply to Baron de Cartier's request for Mr. Akeley's suggestions in relation to the enlargement of the Parc National Albert, he wrote the Ambassador "that there is much of this region that might well be included—the southern end of Lake Edward with its wonderful herds of hippopotami; the Ruindi plains with their lions and their great herds of

antelope of several species; the forests of the Ruindi valley—the haunt of elephant and buffalo—not much more than a graveyard now, but the game would come back if given sanctuary there; the slopes of the volcanoes Nyamlagira and Nyiragongo, of little use except as a reserve for game and for its scenic interest; Lake Bulera, to the east of the Parc—one of the most beautiful of all the small lakes of the region. All these are worthy of being included in the Parc National Albert.”

To Baron de Cartier on the same day he also wrote asking for permission to return to the Belgian Congo to obtain the accessories and painted background for his Gorilla Group, and stating that he had delayed asking permission to do this work pending the establishment of the Gorilla Sanctuary. On this expedition he wished to take with him two scientists, one of whom should be a Belgian, to carry on preliminary studies of the live gorilla.

“I have definite, and I trust good, reasons for wishing to be of the party making the *initial studies* of the gorilla when first approached by man as a friend instead of as an enemy,” he wrote. “It is of great importance that these first observations be carefully made and recorded; that the process of ‘taming’ and making the acquaintance of them be done intelligently, taking every precaution against accidents such as might result in injury to one of the party or unnecessary shooting of a gorilla because of injudicious approach.”

It may be stated here that back in 1921 the officials of the Belgian Government kindly gave Mr. Akeley permission to obtain ten gorillas. He took only five, feeling that this number of specimens was ample for a group that would tell a true story of the gorilla.

In February, 1926, in Brussels, while en route to Africa, we were entrusted with the Mission to the Kivu, which empow-

ered us to execute a general survey of the National Park; to fix on the map native villages, position of forests, bare rocky country, grass lands, cultivated land and pasture, and areas inhabited by gorillas and chimpanzees; to estimate the number of these animals; to study methods of preservation of the fauna, especially the gorillas; and to select suitable sites favorably located and naturally endowed for laboratories and residences for park conservators and visiting scientists.

Later Dr. J. M. Derscheid, of Brussels, research zoölogist, conservationist, and cartographer, joined our 1926 expedition to the Kivu to assist in this survey. After Mr. Akeley's death, Doctor Derscheid's presence made it possible for the expedition to fulfill the mission of the Belgian Government.

In April, 1927, President Henry Fairfield Osborn, who from the beginning was in warm sympathy with the idea of gorilla protection and deeply interested in this rare spot so rich in its possibilities for scientific investigation, received from the Belgian Government a letter inviting the American Museum of Natural History to participate in plans for scientific development and research in the Kivu region. To this he replied that the “American Museum is keenly interested in this great movement.”

In further response, a unanimous resolution of the trustees of the American Museum of Natural History expressed their appreciation of the action of His Majesty and their willingness to coöperate in carrying out plans for scientific development of research in this area.

It was in June, 1927, that Derscheid returned to Belgium, and during a year of military service, prepared an initial report on his gorilla findings and also did yeoman service in the correcting and amplifying of the maps of the region between Lake Kivu and Lake Edward. In September and October, 1928, I spent four



Photograph by Carl Akeley

A VIEW IN THE PARC NATIONAL ALBERT

Here, following Carl Akeley's death, his widow, Mary L. Jobe Akeley, obtained the background and accessories for his Gorilla Group. The horizontal branch in the foreground bears a great platform or cushion of green and golden moss. Frequently giant lobelias and orchids, flowering in tall red and pink racemes, are rooted in these mossy platforms

weeks in the home of Doctor Derscheid collaborating on the preparation of the First Memorandum for the Belgian Government concerning the Parc National Albert.

Our memorandum proposed that the limits of the Park be extended to include the arid active volcanoes of Nyamlagira and Nyiragongo, which are of geologic, volcanologic, meteorologic, and seismologic importance, and also the swamp and sandy lands along the south shore of Lake Edward and the Rutshuru River, in and about which are large herds of hippo and a fair number of antelope. It was further proposed that certain outlying regions of the park be contracted in order to exclude native villages and arable land. Such arrangement would increase the area from 24,000 hectares (the original area set aside) to 200,000 hectares (500,000 acres).

An important section from our plan follows:

We consider the Parc National Albert a Royal Institution, remembering that His Majesty has shown the deepest interest from its creation to the present time. The first words of the Royal Decree give us the essential character and the true meaning of such an undertaking: 'Le Parc est créé dans un but scientifique.' Since the promotion of science is the definite and final goal, not only for today, but also for the benefit of future generations, we wish to emphasize most strongly the necessity of preserving in the park all wild and natural conditions as they now exist.

The richness and exceptional variety of flora and fauna of this region, its extraordinary geological and geographic interest, as well as an almost unique opportunity of saving some of the primitive African pygmies, a race now threatened by extinction, are the chief reasons for demanding that this area should remain inviolate.

Furthermore, on account of the different altitudes—ranging from 2,500 feet to more than 14,000 feet—nearly all kinds of vegetation, from the palm-fringed equatorial rivers to the flower-filled alpine meadows under the snow-



Photograph by Mary L. Jobe Akceley

"THE CASTLE"

The culminating peak of Mount Mikeno, viewed from south of the Saddle Camp at Kabara

capped peaks, are to be found, with a corresponding variety of animal life, thus affording a wonderful opportunity for endless scientific investigation in a rather small area of comparatively easy access.¹ In the proposed area half is mountainous, the other half consists of the sand and swamp lands of Lake Edward.

It is believed also that the region is of practically no economic value, which eliminates conflict between the material development of the country and the interests of science. Furthermore, except for the pygmies who should be left undisturbed in their ancestral way of living because they are few and of slight menace to any living species, the areas are uninhabited.

The memorandum further includes questions of ownership, native rights, jurisdiction, etc.

As a final matter, the question of scientific research is dealt with. It provides for a central station at Rutshuru for the administration of the park and to serve as a permanent base for scientific research; for the use of certain vacant

colonial buildings as a warden's office and domicile, and for the construction of others for the essential use of scientists and desirable visitors. Well equipped laboratories, an adequate scientific library, a small local study museum of geological, botanical, and zoological collections should be established in order to facilitate research.

It suggests also that "small ranger stations be located in places of strategic importance and rich in opportunity for accomplishing a serious survey of the Park, the first being located on the middle slopes of the north side of Mount Kari-simbi on the shore of the small Lake Rukumi, discovered by Derscheid in 1926 near tree line. This pond is above the region of heavy cloud and abounds in the most interesting animal species—gorilla, buffalo, elephant, leopard, hyrax, antelope, squirrel, sunbirds, plaitain eaters, et cetera."

¹The main motor highway from Redjaf to Kisenyi, which is now nearing completion, will run through the Parc National Albert.

In conclusion, the memorandum states that "in view of the determination of the Belgian Government to support the park, which is a region of international scientific importance, and because it seems wise to secure competent direction by men perfectly aware of the needs of scientific research and nature conservation and who have had experience in such matters, it appears wholly desirable to place the management of the park in the hands of a Belgian scientific institution which is so favorably situated as to obtain financial and scientific help both in Belgium and in foreign countries."

This memorandum approved by His Highness, Prince Albert de Ligne, and His Excellency, Baron de Cartier, was submitted to His Majesty, Albert, King of the Belgians, on October 8, 1928, by Prince Albert de Ligne. The following evening His Majesty and Their Royal Highnesses, the Duke and Duchess of Brabant, received in the Palace at Brussels the Belgian Ambassador to the United States and Princess de Ligne, the American Ambassador to Belgium, and Mrs. Hugh Gibson, the Prime Minister and Minister of the Colonies, M. Henri Jaspar and Mme. Jaspar, M. and Mme. Franqui, and other friends of science, as well as Doctor and Mme. Derscheid, and myself. There, throughout a long and intensely interesting evening, the project of the park was discussed.

Derscheid gave an ac-

count of the findings of the Akeley-Derscheid Expedition and projected photographs of the Kivu. I had taken with me to Brussels the gorilla film which Mr. Akeley had made in the Kivu, and this we showed to His Majesty and Their Highnesses.

A few days after our evening at the Palace in Brussels, Derscheid and I described the gorilla country, the plans for conservation, and also our scheme for scientific research therein before the Society for the Preservation of the Fauna of the Empire at the Zoölogical Society in London. At the December meeting of this society Baron de Cartier introduced



Photograph by Mary L. Jobe Akeley

M'GURU, GORILLA GUIDE

He is perched in a moss-covered tree, which was brought to America by Mrs. Akeley as an accessory for the Gorilla Group for the Akeley African Hall

Mr. Akeley's gorilla film and Derscheid again spoke, both expressing the earnest hope that the British Government may make absolute sanctuary of the Uganda side of the gorilla volcanoes.

Inasmuch as the boundary between the Belgian and British volcanoes is not an impassable natural barrier, it is easy for gorillas to range from one side to the other as they undoubtedly do. To have complete protection on the British side would be an unquestionable guarantee that the Belgian gorillas would have absolute sanctuary. Mr. C. W. Hobley, acting as Secretary of the Society for the Preservation of the Fauna of the Empire, wrote me on June 20, 1929, that the society had this matter in hand, and that the Zoological Society of London was supporting the proposal and had taken the matter up independently with the Government.

Throughout the fall and winter months of 1928-29 Prince Albert de Ligne has been untiring in his efforts to push to completion the satisfactory organization of the Park to the end that scientific work be begun and also that the always necessary financial support be secured. Likewise Dr. John C. Merriam, in a letter to me on March 30, 1929, expressed his continued interest:

The Parc National Albert project is to me one of the most interesting and important plans of this nature being studied in the world at the present time and I am extremely desirous of seeing it reach the very high level of effectiveness which I know is desired by all concerned.

As an outgrowth of this keen interest, in the late spring of 1929 a joint expedition to the Parc National Albert was proposed by the Carnegie Institution and Yale University. Permission for the undertaking was received from the Belgian Government through Prince de Ligne. The expedition started for Africa in June, under the direction of Dr. Harold C. Bingham, associate of Dr. Robert M. Yerkes in the Institute of Psychology at

Yale, to conduct a psychological investigation of the habits and behavior of the mountain gorilla in the Kivu sanctuary.

Another expedition, sent out jointly by Columbia University and the American Museum of Natural History for scientific investigation in both the Belgian and French Congo, entered Africa in July, 1929. It is in charge of Henry C. Raven, associate curator of the department of comparative anatomy in the American Museum. The other members are Dr. William K. Gregory, curator of the department of anatomy in the American Museum, professor of vertebrate paleontology at Columbia University, and author of works bearing on the evolution of man; Dr. J. H. McGregor, professor of zoology at Columbia University, and an authority on the anatomy of the anthropoid apes and man; and Dr. E. T. Engle of the department of anatomy at the College of Physicians and Surgeons, Columbia University, and a specialist in endocrinology and physiology. Their object is to trace the source of functional disorders common to both gorilla and man, with a view to alleviating the sufferings of man. These scientists also expect to visit the Parc National Albert to observe the gorilla in his wild state and to study the gorilla's relationship to man. That the findings of both expeditions will be of rare significance is without question.

The crowning achievement in the history of the organization of the Parc National Albert is The Royal Decree signed May 6, 1929, which was confirmed by the Colonial Council and re-confirmed by King Albert in June, 1929. *King Albert has by this act created a corporate body in the Belgian Congo and in the mandated territory of Ruanda-Urundi for preservation of fauna and for strictly scientific purposes.*

The park has been greatly enlarged by this act and now consists of 500,000 acres



Photograph by Mary L. Jobe Akeley

THE HOME OF THE GORILLA

Looking across the jungle-clad lower slopes of Mt. Mikeno to the lava plains below

and comprises four Reserves, or Sectors, lying in the Kivu District, in proximity to one another. Within these Reserves it is forbidden, under penalty of penal servitude or fine, or both, (1) *to pursue, capture, kill, or molest in any way, any kind of wild animal, including animals which are reputed dangerous or harmful*, (2) to take or destroy the eggs or nests of wild birds, (3) to cut down, destroy, or remove any uncultivated plant, or (4) to make any excavation, embankment, boring, or any operation of a nature to change the aspect of the ground or of the vegetation.

Unless provided with a special permit, no one (except officials and others properly qualified) may enter the Parc National Albert, or circulate, camp or sojourn therein, or introduce dogs, traps, or firearms, or possess or transport or export skins or other parts of wild animals or uncultivated vegetable products.

As the four Reserves, or Sectors, of the Parc National Albert include certain tracts of land now occupied by natives or previously granted to private persons or companies, provision is made for the expropriation of these tracts, if found proper and desirable. and it is further provided that even on these tracts under private or native occupation, *the destruction, capture or pursuit of the gorilla, as well as all forms of hunting this animal, are absolutely forbidden.*

To the four Reserves, or Sectors, of the park proper, there are added certain adjacent territories, under less severe restrictions, to serve as protecting zones to the Reserves. These protecting zones are sparsely inhabited by natives. In these zones, hunting, fishing, and, cutting down trees are prohibited, except that the few natives now living there will be permitted to exercise their customary rights which

they now enjoy but only with the primitive weapons which they still use.

The Belgian Colonial Government undertakes to create and maintain, at its own expense, a corps of conservators and a corps of native police, and to pay the strictly administrative expenses of the park. The Parc National Albert is to be administered by a Commission ("*Commission du Parc National Albert*") and by a Committee of Direction.

The *Commission du Parc National Albert* will consist of not less than eighteen members; one-third, including the President, to be appointed by the King; another third to be selected by the King from nominations made by Belgian scientific institutions; and another third to be chosen from among members of foreign scientific institutions.

In addition to its administrative functions, the Commission is authorized, subject to the approval of the King, to accept gifts, legacies, and other donations which may be contributed to further the scientific purposes of the Parc National Albert.

King Albert has already appointed Dr. John C. Merriam and Dr. Henry Fairfield Osborn as members of this commission. This act of the Belgian Government stands as an epochal opportunity for science. Both broad-mindedness and liberality are shown in their willingness to have foreign scientists share in the administering board. It points to that long-hoped-for internationalism in conservation and in science and to a widening interest in protection throughout all Africa.



A NATIVE IN
A GORILLA NEST

Photograph by Mary L. Jobe Akeley



A saw-belly has become firmly lodged in the widely distended jaws of a lake trout

VORACITY IN FISHES

How Fishes, in Their Search for Food, Occasionally Choke on Finny Prey
Too Large to Be Engulfed

By E. W. GUDGER

Bibliographer and Associate in Ichthyology, American Museum of Natural History

WE are all acquainted with the semi-classical allusion to the engineer who was "hoist by his own petard," and with the very unclassical allusion to the boy who "bit off more than he could chew," but that such a fate could happen to a fish is at least unusual. So unusual is this in the experience of even those who have to do with fishes that it seems well worth while to set forth the facts about the fishes pictured above, and also to bring together as a background the few scattered instances and figures of like occurrences known to the writer.

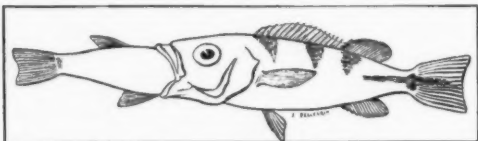
Carnivorous fishes, while not averse to other animal food, find their chief alimentation in their finny fellows. It is interesting to note what large specimens are swallowed, compared with the size of the aggressor and the capacity of its stomach. At Tortugas, Florida, I once dissected a

22-inch red grouper (*Epinephelus morio*), which had in its 8-inch stomach an 11½-inch snapper, 3½ inches of whose tail protruded from the oesophagus into the mouth of the grouper.

The fishes pictured in the headpiece of this article are a lake trout (*Cristivomer namaycush*) which attempted to swallow a saw-belly (*Pomolobus pseudoharengus*) with dire results to both. These fishes were picked up on the shore of Lake Keuka, in New York State, about 10 A.M. on August 2, 1929, by Arthur A. Jansson, Jr. and by him presented to the department of ichthyology of the American Museum. Both fishes were dead when found, but were still limp. Possibly their mutual decease had occurred that morning, certainly not earlier than the night before.

There is nothing unusual in the attempt of the trout to swallow the saw-belly,

since small specimens of the latter are the favorite bait used by trout anglers on this lake. The unusual thing is that the trout (8¼ inches long over all) attempted to swallow a saw-belly (5 inches long and 1 inch deep) which was too large for his capacity. The trout could not work his



AN UNTIMELY FATE

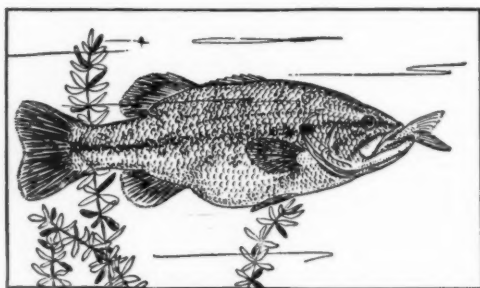
This greedy young Cichlid attempted to swallow a fish almost its own size. After Pellegrin, 1903

(relatively) large prey down into a stomach too small to contain it, nor could he disgorge his capture. The head and foreparts of the saw-belly (measuring 1¼ inches) fitted very accurately into the mouth and pharynx of the trout and distended its jaws so widely that the teeth caught in the dorsal and ventral surfaces of the body of its prey and held it fast. However, another factor in retention is found in the peculiar structure of the body of the saw-belly which gives it its name. The body of this fish is shaped like a capital V, the two sides of the abdomen coming together in a sharp angle on the midventral line with the scales so set as to give this line the appearance and feel of a saw with the teeth pointing backward. These teeth catching inside the anterior angle or "point of the jaw" of the trout made it impossible for it to disgorge its prey. With a glass one may note in the drawing the sawlike edge of the ventral surface of the fish.

Since the fishes were bent to get them into the container in which they were brought to the Museum and since they have become hardened in the preservative, it is impossible to photograph them in lateral view. The spirited sketch at the head of this article was made by Arthur A. Jansson, Sr.

Undoubtedly there are to be found, especially in sporting journals and in books on angling, accounts of such happenings. Few, however, have come to hand, but these will be of interest as a background to the accident described above. The first is by the distinguished French ichthyologist, Jacques Pellegrin, who has figured such an incident on page 130 of his memoir on the Cichlidæ (fresh-water perch-like fishes found mainly in Africa and South America (*Memoires Société Zoologique de France*, 1903, tome XVI). This figure, which is reproduced on this page, shows a young Cichlid only 45 mm. (1¼ inches) long, attempting to swallow a fish but little smaller than itself.

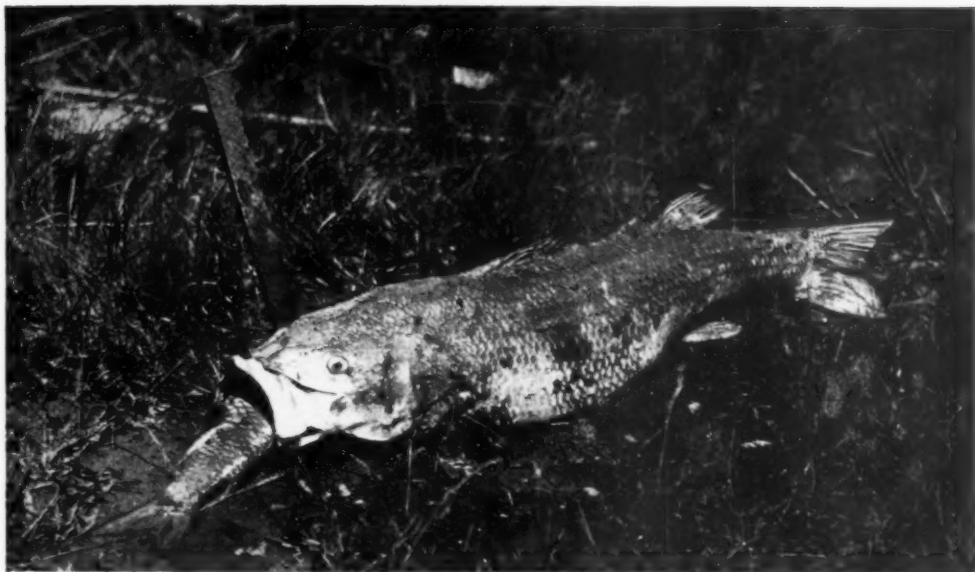
Among our North American carnivorous fishes, the black bass (especially the large-mouthed form, *Micropterus salmoides*) is particularly voracious. That this voracity begins early in life is revealed in notes on the rearing of this fish by Leon J. Pray, published in *Aquatic Life* (1918, Vol. IV, pp. 77-79). He found that his baby bass early developed cannibalistic characteristics. "The larger and stronger ones quickly swallowed the smaller, afterwards going slowly about with



A CANNIBALISTIC BASS

The tail fin of its twin brother projecting from its mouth revealed the voracious appetite of this baby black bass. After Pray, 1918

the tail fins of their brothers and sisters protruding from their mouths"—as may be seen in the figure at the bottom of this page reproduced from his sketch of



Courtesy of Field and Stream

CHOKED BY ITS PREY

A 44-pound striped bass which met with disaster when it attempted to swallow a 2-pound carp

one specimen. This kept on until only two were left, and inspection of the aquarium one morning showed but one fish. However, the aldermanic outline of the survivor and the caudal fin of his twin brother projecting from his mouth told the tale of the nocturnal tragedy.

This little bass was then supplied with small live minnows on which he fed regularly twice a day—in mid fore- and afternoon—consuming 160 before attaining an age of three months and a length of slightly under three inches. He would catch his prey midwise, deftly shift it about until he had it “head on,” when it would be quickly engulfed. But “Nearly always the tail of the minnow protruded from his mouth for two or three hours afterward.” However, as the minnows were small and the mouth and gullet of the little bass relatively large, this impetuous feeding was carried on without such a fatality as has been depicted in this article.

Of a related form, the fresh-water perch (*Perca fluviatilis*), H. Cholmondeley-

Pennell writes in his interesting book *The Angler-Naturalist* (London, 1863, p. 60), that when a perch has filled its stomach to repletion with minnows, it will still endeavor to catch others, and that “it is by no means uncommon under these circumstances to capture a Perch with the tails of the minnows, which he has already partially swallowed and been unable to pouch, protruding from his gullet.”

Corroboratory of this, C. M. Breder, Jr., of the New York Aquarium, tells me that he once found in a stream in New Jersey a black bass about 5 inches long, which had been killed in trying to swallow another bass about 3 inches long—the posterior third of the smaller fish protruding from the mouth of the larger.

A similar fate overtook a striped bass (a related marine form which ascends rivers for some distance) found in the San Joaquin River district, California. This fish's photograph was published on page 78 of *Field and Stream*, New York, for December, 1928, and is reproduced on this page. No explanation or account of

it is given other than the caption, which says "This 44-pound striped bass met with disaster when he attempted to swallow a 2-pound carp"—the tail of which protruded from his mouth. Whether the bass was choked to death, or whether it was caught in a net before the swallowing process was over, cannot be said.

The most ravenous fishes found in the fresh waters of Europe and North America are the pikes, members of the family Esocidæ. Definite accounts of mishaps among pikes, similar to those shown on pages 553, 555, are known. First of all to be quoted is E. J. Stanley, who, writing in *The Zoologist* (1845, Vol. III, page 1039), says that, once when walking by a piece of water, he heard a commotion, and coming nearer he "found two pike, of about a pound each, the head of one being entirely within the other's mouth, the snout coming out at the gills of the fish that was holding it." Stanley was able to catch these two fish since "they seemed nearly exhausted with their exertions"—a thing at which one can hardly be surprised.

A similar and equally well authenticated account is narrated by Sir Herbert Maxwell in his *British Fresh-water Fishes* (London, 1904, p. 169). In 1870 two fishermen on Loch Tay, Scotland, noticing a disturbance in the water, rowed to the spot and found two fish apparently fighting. When gaffed and pulled on board they proved to be a pair of pike weighing 19 pounds and nearly of the same size. "The head of one was firmly fixed as far as the pectoral fins within the jaws and gullet of the other."

Of the voracity of the pike and the rapidity of its digestion, Cholmondeley-Pennell gives many instances in the book previously referred to. Of these the one on page 197 is to the point. A pike, lying in a semi-torpid condition among some water weeds, was easily caught and brought ashore. The explanation of this behavior was then found in the presence

of a large eel stuck in the pike's throat, the head parts of which had been swallowed and partly digested, while the tail protruded out in the water.

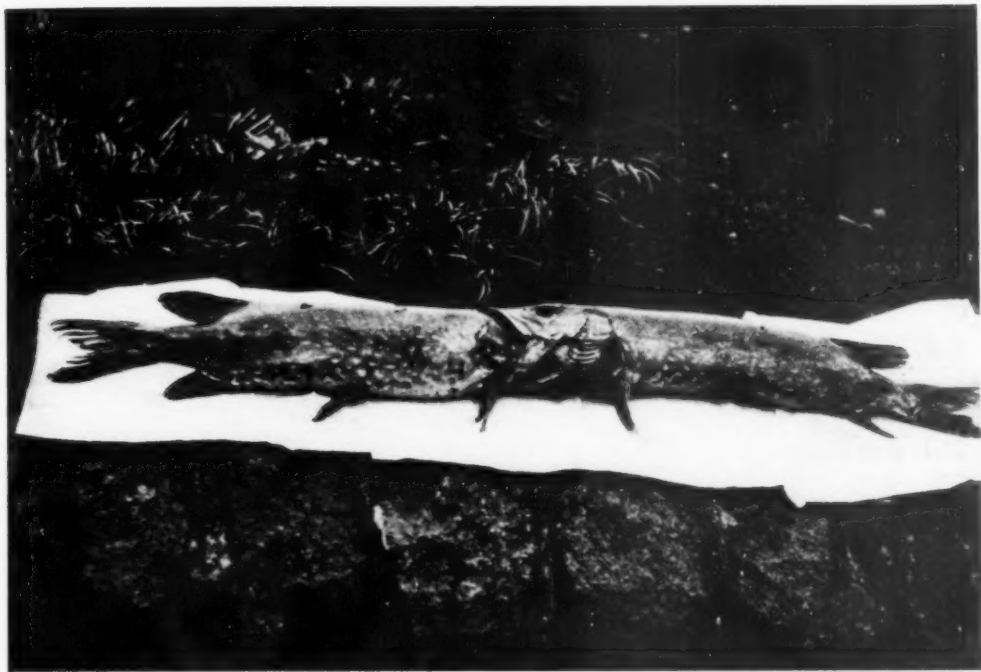
This particular matter of digestion of the head end of the prey also is corroborated by Mr. Breder's repeated observations on the fishes in the New York Aquarium. Specifically he tells of a 5-foot sand shark which captured and partially swallowed a dogfish about half its length—leaving about 10 inches of the dogfish's tail projecting beyond its jaws. For about two and one half days it swam around in the large aquarium with the tail of its prey waving in the water, until as a result of the progressive digestion of the anterior parts, the tail was slowly taken in.

Illustrative not merely of the voracity but of the cannibalistic proclivities of the pike, Cholmondeley-Pennell relates (page 198) that, on a line set overnight in the River Avon, a large and heavy pike was found. In order to get out the hook, the fish was opened and in it was found another and smaller pike with the line proceeding from its mouth. Dissection of pike number 2 revealed in its stomach a still smaller pike, number 3, the original taker of the bait. Surely this is the champion "fish story" illustrative of voracity in fishes.

Anent the matter under discussion, Jonathan Couch writes (*British Fishes*, 1869, Vol. IV, p. 152):

It [the pike] has been known on some occasions to seize and devour one of its own species almost as large as itself. When this occurs, however, the whole body of the prey cannot be received at once into the stomach; and the devourer has been seen with the tail and a portion of its victim protruding from its mouth, until by a dissolution of a part there is room afforded for the remaining portion to be in turn subjected to the power of digestion.

Not all the cannibals of the genus *Esox* are so fortunate in their attacks on their fellows. C. Tate Regan, the director of the British Museum, relates (*British*



Courtesy of Field and Stream

A DUEL TO THE DEATH
Mutual destruction of two pikes in White Loch, Scotland

Freshwater Fishes, 1911, page 145) that in one season two pikes, weighing 35 and 29 pounds respectively, were found floating dead on a lake in Dorsetshire. Each had tried vainly to swallow a fish about one third of its own size, a pike in one case and a carp in another, and each had perished miserably.

Unfortunately illustrations are lacking in the accounts just quoted, but I am pleased now to present ocular evidence of cannibalism in pikes in the form of a photograph kindly lent me by Mr. Ray Schrenkeisen, associate editor of *Field and Stream*, New York. These fish were photographed at White Loch, Monreith, Scotland, whence they were taken. This photograph was reproduced on page 78 of *Field and Stream* of December, 1928, but no data are given other than that one fish weighed 7 and the other 8 pounds. (From this one may conjecture that, as in the case of my fishes, it was possible to separate them after death). Evidently the larger

fish got the head of the smaller fish in his mouth, where the gill covers of the latter stuck in the gill arches of the former, causing a great distension of the mouth and gill covers of the aggressor as may be seen in the figure. The two fishes, being unable to get free from each other, either died a slow and painful death (let us recall here the stories of deer with interlocked horns) or possibly before this were so weakened that they were easily caught.

A possible explanation of how this state of affairs comes about is to be found in an incident related by Cholmondeley-Pennell in the book (page 214) previously quoted. Two pike were kept in a glass aquarium. When a bit of food was thrown in this about midway between them, they simultaneously dashed at it, with the singular result that the head of the smaller fish penetrated the open mouth of the larger, where it was so firmly fixed that it was some time before the two fish freed themselves from their unfortunate predicament.



At the entrance to the forest.—The figure on the trail stands at the viewpoint of the habitat group of Barro Colorado in the American Museum

AIR CASTLES IN THE TROPICS¹

A Review of "My Tropical Air Castle," Dr. Frank M. Chapman's New Book on Barro Colorado Island

By FRANK E. LUTZ

Curator of Insect Life, American Museum

AIR Castles in the Tropics—at least the one which Doctor Chapman calls his own—are most interesting and seem to be filled with scientific realities surpassing mere dreams. He calls it his own, but, with the generosity of a scientist, he invites us to share his dream-come-true and, with the skill of an experienced writer, he makes us feel at home. There are few who have seen more of the American Tropics than he has or who are as well qualified to speak of its natural history.

What, then, is this Barro Colorado and why has it become the site of the castle? A brief notice of Doctor Chapman's book can certainly not fully answer these questions, and even the book itself, devoted as it is to the answering of them and full of

charming detail, rightly leaves the reader with an impression that the half has not been told.

Barro Colorado, speaking geographically, was a mountain in the valley of the Chagres in Panama. With the damming of that river to make the Panama Canal, Barro Colorado became an island in Gatun Lake. Speaking biologically, it is a typical example of a tropical forest, and it is now surrounded by a protecting barrier of water. Administratively, it is further protected by a governmental proclamation which has placed it in charge of a committee of the National Research Council to be used as a center for the investigation of tropical biology.

The American Museum's first contact with Barro Colorado was when one of our

¹*My Tropical Air Castle*. By Dr. Frank M. Chapman. xvi 417 pp. 29 text figures; 47 plates. D. Appleton and Co., N. Y. City.

entomologists hunting stingless bees camped on the site of the present laboratory and cut the first trail through the forest. Now "there are nearly twenty miles of these pathways and not one tree of size was felled in their construction. They are cross-sections through the life of the forest, and afford unending possibilities for intimate views of beast or bird and the forest itself. One may follow them almost as noiselessly as he glides along the shore in a cayuca. Instead of being an enmeshed, perspiring, vituperative creature he now feels more a part of the fauna."

One of the book's illustrations reproduced here gives a daylight glimpse from the laboratory clearing of a main trail, and the other photograph is a flashlight portrait of a puma made on a near-by path with the unintentional coöperation of the photographed. In fact, a novel and very

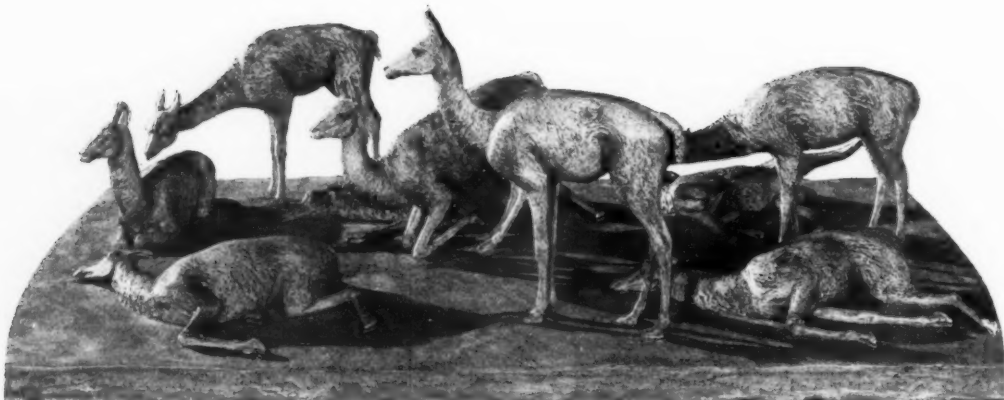
acceptable part of the book's numerous illustrations is a series of such auto-portraits in connection with a chapter on "Who Treads Our Trails?"

The American Museum's second contact with Barro Colorado and Doctor Chapman's discovery of his long-sought Air Castle was his expedition to make studies for the habitat group of tropical American forest birds now on exhibition here. Since then we have come to look upon the Barro Colorado laboratory as a regular part of our Museum activities. So, this book is by way of being an American Museum report, but it is a very readable report that will appeal to all who are interested in tropical natural history—"beast or bird and the forest itself"—described by one who knows and who does not hesitate to season his descriptions with humor and human feeling.



A PUMA PHOTOGRAPHS HIMSELF

Note the broken wire which was connected with the camera. The presence of this species, tapirs, and other large animals on Barro Colorado is an indication of the primeval character of its fauna



A restoration model of the Miocene camel group, made by Louise Waller Germann under the direction of Barnum Brown

A MIOCENE CAMEL BED-GROUND

A Recently Installed Exhibit at the American Museum, Showing a Phase in the Lives of the Now Extinct Camels that Originally Ranged the Grassy Plains of Western Nebraska

By BARNUM BROWN

Curator of Fossil Reptiles, American Museum

SINGLE skeletons of prehistoric animals are not uncommon, but to find a herd, dozens of which are complete, entombed at one place, is a rare occurrence. Such was the find near Agate Spring in Western Nebraska, where nearly a hundred skeletons of the little camel *Stenomylus hitchcocki* were found close together.

This remarkable deposit was discovered by Dr. F. B. Loomis, of Amherst College, in 1907. In 1908 he excavated twenty-one skeletons there for Amherst College, and several other institutions shared in the find. Yale University secured three skeletons, and the Carnegie Museum, in 1908 and 1909, about thirty skeletons.

In 1908 Mr. Albert Thomson collected nine skeletons from the same deposit for the American Museum of Natural History. It is this group of nine skeletons that recently has been mounted, and displayed with models, five in characteristic, life-like camel attitudes, four lying in the original matrix as found.

Judging from the number of skeletons buried in this quarry and their rarity elsewhere, we suppose that *Stenomylus* was in habits similar to the guanaco of South America.

The guanaco feed over the pampas singly and in small groups during the summer but, as winter approaches, they band together in great herds of thousands. During severe winter weather in Patagonia, the writer has seen a herd of five thousand bedded close together like sheep. When they arose from the bed-ground in the morning, a hundred bodies remained dead of starvation and winter kill.

Our mounted group recalls such a morning scene; a section of the bed-ground from which most of the living have departed. A few stragglers remain, the largest presumably a male. A mother stands close to her young which lies, like all camels, with legs folded, the front feet palms up—the hind feet with palms down. Another is rising, in which movement the hind feet are first straightened, the

forward part of the body resting on the elbows; with a spring the animal comes up on all fours.

It was similar bed-grounds that Charles Darwin observed on the pampas during his summer's visit to South America, described in the *Naturalist's Voyage Round the World*, but as the guanaco were then feeding singly and in small groups, he thought it was their habit to go to certain places to die.

Like the guanaco, most of the *Stenomylus* skeletons were close together, with bones articulated and heads drawn back, although some of the bodies had been mutilated and torn apart by carnivorous animals. Later these bodies were covered first by wind-blown sands and later by river drift.

The camel family originated in North

America and flourished here until near the close of the Pleistocene period, when they, like the horses, died out before the coming of the white man.

The family is now represented by the genus *Camelus* of which there are two species; in North Africa and Arabia, the Arabian camel with one hump, and in Central Asia the Bactrian with two humps. The true camels are distinguished by these humps, which are in reality huge masses of fat that serve as a reserve store of food. A closely related genus is the *Auchenia* of South America, of which there are two wild species, the guanaco and the smaller vicuna. The llama and alpaca, beasts of burden, are regarded as domesticated varieties of the two wild species.

The South American camels are grass grazers and in habits very different from



EARLY MORNING

Miocene camels (*Stenomylus hitchcocki*) leaving a bed-ground. The herd leaves behind it each morning those of its numbers that have succumbed to starvation, old age, or inclement weather.

From a painting based on the group, by Mrs. E. Rungius Fulda



QUARRY WHERE THE CAMEL SKELETONS WERE FOUND

Scene of the American Museum's operations in 1908, five miles southeast of Agate Spring, Sioux County, Nebraska

Asiatic and Arabian camels, so important to the inhabitants of those countries. No desert traveler equipped with a well organized camel caravan could fail to respect this interesting animal. Sometimes called stupid; often complaining, but never failing. His wants are few and his burdens many.

With Arab drivers who know their camels, a white tent village will literally melt away and the long caravan be on the march with scarcely a sound. But with Somali drivers and the same camels, to break camp is confusion confounded.

The Arabian camel never falters; over blistering, slithering sand, or jagged lava flow, his footfalls are as regular as heartbeats, and after the long day's march, with burdens removed, he ambles away, never seeing the grass he tramples, to carefully choose his thorny titbits, from mimosa or acacia trees. Truly he is a marvelous beast.

Next to the horses, the camels furnish

the most striking and best known series illustrating the evolution of a race of mammals. They passed through nearly the whole of their development in North America and did not migrate to other continents until the late Miocene or Early Pliocene.

Camels appear first in the Eocene as very small animals with four complete toes on each foot; the neck and limbs of only moderate length. Probably, like other races, they were descended from a five-toed animal, but this initial ancestor has not yet been discovered. *Protylopus*, one of the first genera known, is probably not in direct line of descent, but it nearly represents the proper ancestral stage. It was an animal scarcely larger than a jack rabbit.

In each succeeding epoch we find the race increasing in size and gradually losing its side toes, which become slender, then the tips of the toes disappear leaving only splint-bones, then the splint-bones

are reduced to small nodules and finally disappear completely. The two central toes are at first entirely separate, but their upper bones become consolidated into a "cannon-bone." The toes at first had small sharp hoofs like those of deer or antelopes, but gradually a large, soft, elastic fibrous pad was formed, which enables the animal to walk on soft, shifting desert sands or equally well on the sharp irregular surfaces of lava fields.

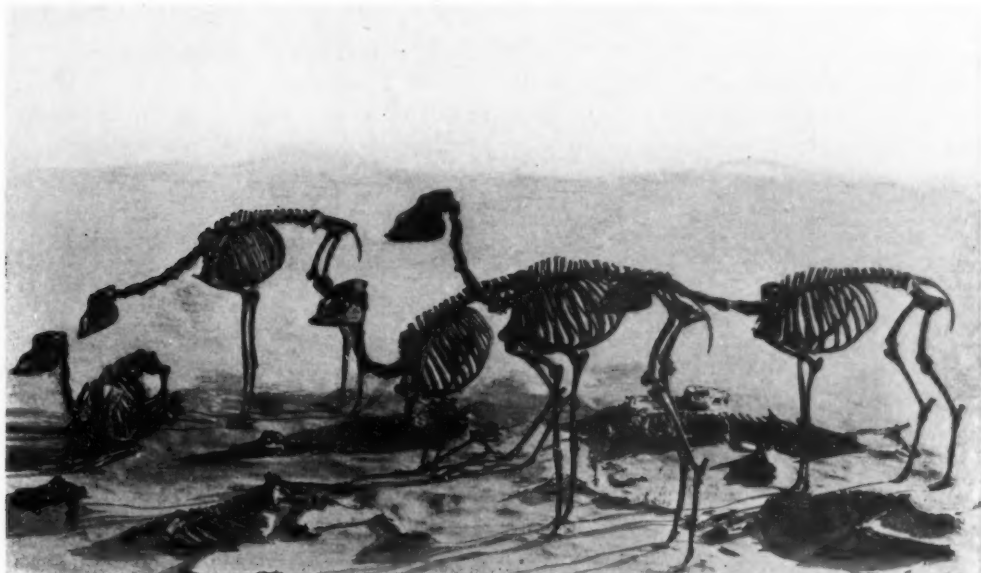
The teeth in the earliest camels are of primitive pattern, adapted to an omnivorous diet; but they gradually become fitted for browsing with grinding teeth of four crescentic ridges. The premolar teeth become dwarfed and disappear; so do the upper incisor teeth, the lower incisors being pressed against a flexible upper lip to nip off the leaves or grasses.

During the Miocene, the period in which our little *Stenomylus* lived, the family became diverse in size and is represented by several genera and many species. *Stenomylus* lived during Lower Miocene

times, and its race apparently had a brief career—disappearing in the Lower Miocene. It was an upland feeder, unique among camels in having the first premolars and canines developed like incisors; a modification that doubtless related to its feeding habits. *Oxydactylus*, a contemporary of *Stenomylus*, was a more hardy type and precursor of the "giraffe-camels."

Camels reached their maximum size and abundance in the Pliocene Epoch. In the Lower Pliocene the two modern phyla had separated, and there was a third now extinct—a very long-legged, long-necked group, the "giraffe-camels" whose appearance and habits probably were much like the giraffe.

At this time camels were the most numerous of all the large animals of the plains, and some were of gigantic size, one species discovered in Arizona in 1928 being a third larger than the largest living camel. They ranged all over North America, and the uniting of this continent with



THE GROUP OF MIOCENE CAMEL SKELETONS

(*Stenomylus hitchcocki*)

Five of the skeletons in the group are mounted in characteristic camel attitudes, and four others are lying in the original matrix as found. Mounted by Charles J. Lang



GENERAL VIEW OF *STENOMYLUS* REGION

It was here in 1907 that Dr. F. B. Loomis of Amherst College made the remarkable find of nearly 100 skeletons of *Stenomylus hitchcocki*, and in 1908 Albert Thomson collected nine skeletons for the American Museum, which have been mounted and are now on display with restoration models

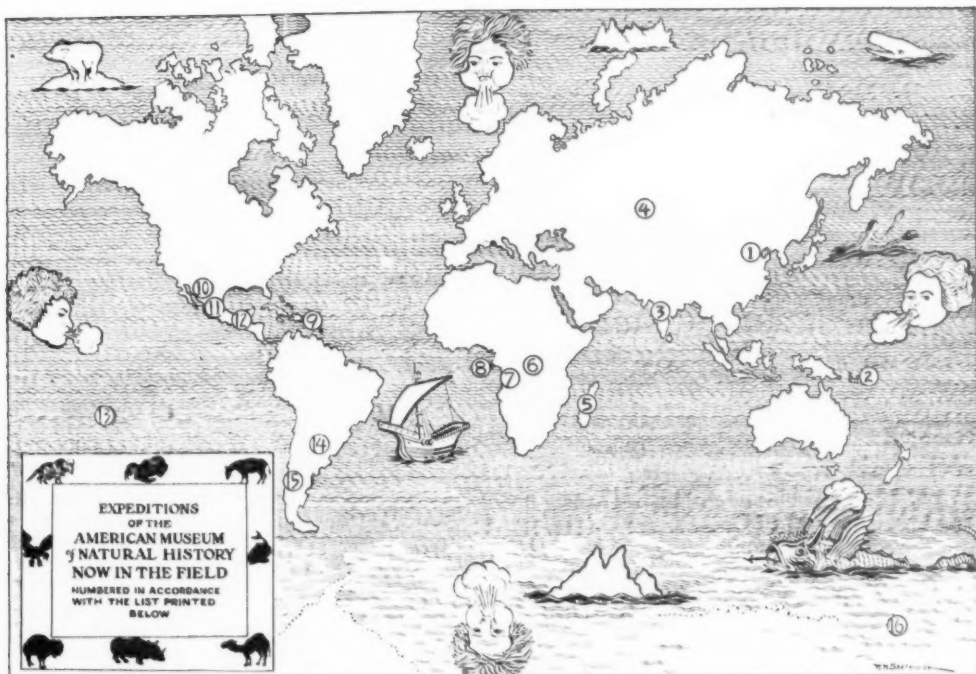
South America and Asia enabled them to spread over the greater part of the Old World and most of South America. Since that epoch they have declined in numbers and their range has become more restricted.

The camel has entirely disappeared

from North America where it originated and reached its maximum size. In short, the race is becoming extinct, to be replaced by the higher ruminants (antelopes, sheep, and cattle) which are now at the zenith of their prosperity.



AMHERST HILL AND
Stenomylus QUARRY



1. Central Asiatic; 2. Whitney South Sea, Solomon Islands, for birds; 3. Vernay-Faunthorpe for Asiatic Mammals; 4. Morden-Graves, Turkestan, for mammals; 5. Madagascar, for birds, mammals, and fossils; 6. Tanganyika, for birds and mammals; 7. Columbia University-American Museum, to Africa for anatomical study; 8. Thorne-Correia, Gulf of Guinea, for birds; 9. Heilprin-Hassler, Haiti, for reptiles; 10. Frick-Rak-Falkenbach, Sante Fé, for fossils; 11. Vaillant, Valley of Mexico, archaeological study; 12. Heilprin-Hatt, Yucatan, for mammals and fossils; 13. Shapiro, Polynesia, physical anthropology; 14. Naumburg-Kaempfer, Southeastern Brazil, for birds; 15. Otteley-Anthony, South America, biological reconnaissance; 16. Byrd, Antarctic

AMERICAN MUSEUM EXPEDITIONS

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY informed as to the latest news of Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data

THE Columbia University-American Museum Expedition to Africa reports that it has obtained one of the two gorillas permitted it by the Belgian government. The gorilla, a magnificent male in the prime of life, was a staggering load for twenty-five porters. Inasmuch as the party can collect but two specimens, great care was exercised in the selection. Doing this was complicated by the fact that they live in the thickest bush where one can seldom see more than an indefinite shadow. After the second gorilla has been obtained, the work of photographing living gorillas will begin, but Dr. William King Gregory writes that the conditions are most difficult, and only a fortunate chance can yield any photographs of value. The gorillas are masters in the art of concealment and of disappearance. Doctor McGregor managed to get within speak-

ing distance of a family party of them nearly a week ago, and, writes Doctor Gregory, all are hoping for similar opportunities soon.

Of Africa, Doctor Gregory continues:

At every step, east and central Africa contradict all one's preconceptions. In the first place we have as yet experienced no really hot weather except at Djibuti near the Red Sea. Here in the mountains at 6700 feet elevation, it is moderately hot at midday and almost freezing at night. Then, too, I expected to see deadly snakes and venomous insects, but although I have searched constantly in the bush and jungle for snakes I have seen not one, while insects are relatively few and largely innocuous. Probably this paucity of life is largely due to the constant burning of grass and bush by the natives in order to gain grazing space for their cattle. Goats and cattle are devastating Africa as they are Australia.

We are fortunate in being camped here in a paradise of lush green fields sprinkled with brilliant trees and flowers. The natives furnish us with a continuous performance. We see them everywhere in their settlements, and at present we are surrounded by forty porters and four "personnel" boys. Every one of them could be studied individually by a staff of anthropologists, sociologists, humanists, physicians and others. Moreover they are equally interesting, from the larval stage to tottering old age. With what gusto the

tiny boys greet one with a snappy salute and a quavering "jambo," and how the mothers love to have their babies photographed, from all sides and angles, especially if a franc (35¢) is forthcoming. Yesterday three of us walked down and up the mountains to a great native market about eight miles from here. We were like pilgrims marching to Mecca in the midst of a toiling stream of black humanity.

WORD has just come from Mr. and Mrs. R. T. Hatt of the Angelo Heilprin Yucatan Expedition that they arrived at Chichen Itza on October 12. They say:

The country here is strikingly different from what we anticipated. Instead of being xerophytic, everything is covered with a dense tangle of wet green brush—all overgrown with convolvulus (twining herbs). There has been rain every day since we arrived.

The ruins are beautiful beyond description. We have not had time to study and visit them all yet. The carvings and paintings take a long time to study and one cannot grasp all the details at one glance. Before we leave we will take a day off to see what we have not seen and take a few pictures.

Speaking of pets, we should tell you that our thatch roof contains as much life as the sea. Scorpions, tarantulas, big cockroaches, geckos, bats, different kinds of wasps, mantis, spiders, and many more live about our heads. We do not mind them, but wish that the scorpions and tarantulas

would stay there instead of falling or perhaps walking down and coming so near our feet. Almost every day we meet a tarantula or scorpion. Last night we had two tarantulas. An entomologist would have a good time here. By the way, roaches fly in this country.

ON November 1, Dr. George C. Vaillant left New York to resume the stratigraphical excavations in the Valley of Mexico, continuing at the sites of Ticoman and possibly Teotihuacan, the work begun last season. In January he plans to go to a conference at Chichen Itza at the invitation of the Carnegie Institution at Washington, to report on the progress of his archaeological work.

ACARD from William J. Morden of the Morden-Graves Expedition for mammals states that on September 27 his party was at Tashkent. From there they plan to go on to Samarkand and Bokhara, and shortly after the first of November to strike eastward to Siberia.

NOTES

ASTRONOMY

BY invitation of the Bond Astronomical Club of Harvard College, Dr. Clyde Fisher, president of the Amateur Astronomers Association, made the opening address at their meeting, October 28, 1929, at the Harvard College Observatory, in which he described the mechanism of the Zeiss Planetarium. The following evening Doctor Fisher addressed the American Association of Variable Star Observers at their annual fall meeting at the Harvard Observatory.

COMMENCING Saturday, December 7, from 5:30 to 5:45 P.M., Station WOR will broadcast a series of radio talks on astronomy under the auspices of the Amateur Astronomers Association. Dr. Clyde Fisher, president of the Association, will give the initial talk. Dr. C. S. Brainin of Columbia University, Dr. Oswald Schlockow, and Anthony Fiala are scheduled for the three succeeding broadcasts, respectively.

THE December program of the Amateur Astronomers Association will include the following speakers:

December 4, Dr. John A. Miller, professor of mathematics and astronomy, Swarthmore College. "The Eclipse of 1929." (Illustrated).

December 18, Dr. John C. Duncan, professor of astronomy at Wellesley College. "The Nebulae." (Illustrated).

THE motion picture reels illustrating the Einstein Theory of Relativity, which were the feature of the November 6 meeting of the

Amateur Astronomers Association, attracted an attendance of 3000 people. It had to be projected on the screen twice during the evening to accommodate this record audience. Many calls are being received for another showing, and it is possible that this may be done later for members only.

The November 20 meeting was devoted to a description of "Our Place in the Milky Way Galaxy" by Dr. Clyde Fisher.

THE MARTIN JOHNSON- AFRICAN EXPEDITION

ON November 2 Mr. and Mrs. Martin Johnson sailed for Africa, to be gone for a period of two years. Accompanying them on this trip are Mr. George Dryden of Chicago, and his son, who will be with the Johnsons for the first three months.

DeWitt Sage of New York will join the Johnsons in Nairobi to assist Mr. Johnson in his photographic work. Also on this trip there will be a sound and camera man from Fox Movietone.

Mr. Johnson is taking along the new Grandeur Movietone outfit, (70 millimeter), also a camera for making color pictures, and an outfit to make sound pictures.

The party after visiting the Johnson's Nairobi home, will go to the slopes of Mt. Kenya, where Mr. Johnson hopes to photograph the bonga.

Next they will go to the Ituri forest in the Belgian Congo and make camp on the Ituri river. Here they expect to photograph the gorilla, pygmy people, pygmy elephants if they

exist, and also the okapi, which Mr. Johnson describes as a cross between a giraffe and a zebra, although it really is not. The okapi is a very rare animal and has almost never been seen by a white man, although the natives have killed them from time to time and brought them in.

EDUCATION

THE Cultural Courses for Teachers, inaugurated this fall by the department of public education of the American Museum, proved to be very attractive to hundreds who were evidently impressed by the illustrative resources of the Museum and by the quality of the lectures.

Enrollment in the Tuesday afternoon course in geography for elementary school teachers climbed to the unprecedented total of 1311. The course on Wednesday afternoons arranged for teachers in secondary schools totaled 232.

Dr. George H. Sherwood, director of the Museum, gave the opening lecture in each course. He used photographs of wild animals contrasted with pictures of the habitat groups of the same animals, prepared by the experts of the Museum for exhibition in the various halls, to show the scientific fidelity of the exhibits of the Museum. He also analyzed the development and growth of the Museum, particularly in education. His slides and films were enthusiastically received by both audiences, and his entertaining and valuable talks were generally taken to be harbingers of the good things to come in the courses.

While the extremely large registration has compelled some adjustments in the methods of presenting the courses, it is hoped that it will still be possible for each of the registrants to complement the lectures with a certain amount of laboratory work and accessory reading.

BEAR MOUNTAIN NATURE TRAILS

All trails leading through the woods, along the margins of lakes, or over the tops of mountains, are, in effect "nature trails." Unfortunately, however, not many trails aid in disseminating information about nature to the uninitiated who tread their paths. The purpose of labeled "nature trails" and of "trailside museums" is to present opportunity to nature lovers to gain a real conception of the meaning of "nature-mindedness," by providing them with simple, visual means of becoming better acquainted with the wonderful world in which they live.

The dwellers of the cities are turning their eyes, their steps, and their mental perceptions to the woods, the fields, and the streams. In ever increasing numbers they are availing themselves of many opportunities to spend hours in the open. State and national parks are being

used eagerly by the general public, who have learned to journey away from the crowded centers of population in search of recreation and fresh, pure air.

The department of public education of the American Museum has kept pace with the times in following the footsteps of the people of Greater New York in their exodus to the open. Many other organizations throughout the United States have seen the value and importance of this form of nature education and now support similar projects, all with the one purpose of stimulating a more lively and lasting interest in the out-of-doors on the part of the American public. The Nature Trails and the Trailside Museum, maintained by the American Museum of Natural History, in coöperation with the Commissioners of the Palisade Interstate Park at Bear Mountain, New York, have been visited by more than 200,000 people since 1927.

The development during the season from May to October, 1929, has progressed rapidly in several directions. The third year of operation has seen an increase in attendance nearly double that of 1928. The trails are now completely indicated and marked, and the museum building, provided by the Laura Spelman Rockefeller Foundation, is fully equipped with exhibits and demonstration materials, nearly all of which have been made at the Trailside Workshop. This new workshop has proved a most valuable acquisition. Coöperation with the educational and camping department of the Interstate Park has been carried on in a more extended way than heretofore. A new branch of the work, initiated this year, is that of aiding in a very definite way nature councilors and directors throughout the Park, with their individual museum and general educational problems. The evident increase in interest on the part of the public in trailside museums and in the nature of the trails has shown itself in many ways, and is most encouraging.

Major William A. Welch, general manager and chief engineer of the Interstate Park, has been most kind in his willingness to aid the nature program of the Trailside Museum. Miss Ruby M. Jolliffe, superintendent of camping in the Park, by her friendly assistance aided the extension work of the Museum very materially. Mr. John Tampsen, chief of construction, has also been very helpful as have the entire police force of Bear Mountain under the direction of Captain Mandago. Dr. George H. Sherwood, director of the American Museum, has given valuable help and has made possible many new features of the work. The support of Dr. Clyde Fisher, curator

of visual instruction at the American Museum, has also been of great assistance.

The Nature Trails, the Trailside Museum, and the educational extension work, have again been directed by William H. Carr, assistant curator of education at the American Museum. Mr. Carr has been assisted by his wife, Marion B. Carr.

A relief model of the Nature Trail area has been installed in the Trailside Museum this summer. It shows, in raised contours, the different trails, and points of interest, and not only gives specific direction as to the location of certain "natural history events," but it also serves as a general guide to the region, teaching the visitor at the same time how to read contour maps correctly.

Indoor exhibits of living animals have been greatly increased, both as to numbers of species exhibited and interesting species cared for. A complete equipment of new cages and other physical means of exhibiting the creatures to the best advantage have been designed and made in the Trailside Workshop. About fifty of these new cages have been in use. At one time during the season the Trailside Museum had thirteen species of local snakes, all properly housed.

The exhibit of microscopes continued to be the most popular educational feature in the museum building. Indeed, the floor in front of the microscope table was quite worn by the feet of people, many of whom were permitted for the first time actually to use a microscope.

A new exhibit that showed "something to do with leaves" attracted many visitors, both adults and children. The only glass case in the building was used for this exhibit. Here were shown the various steps by which different kinds of impressions could be taken of leaves.

This year the "Return Trail," the "Swamp Trail," and the "Hidden Label Trail," were completely marked. The labels on the historical trail were all replaced, and sturdy chestnut posts were firmly fixed so that this particular trail should be virtually permanent. New exhibits along the trails included the insect table and the turtle pens. Many new labels were added to the entire trail system. All damaged labels were replaced almost as rapidly as they became scratched or otherwise mutilated.

The new building at the end of the trail designated as the "Trailside Workshop" has given excellent service to the entire nature project. It served as living quarters for four people, as a workshop for the trails and the museum, and as a nature laboratory for more than one hundred nature councilors and directors in the camps of the Interstate Park.

During the early part of the camping season, announcement was made through Miss Jolliffe, of the Park Staff, to many of the camp directors in the Park area, to the effect that the directors of the Trailside Museum would be glad to give instruction to Nature Teachers in the way of caring for their captive animals. The teachers responded at once, and during July and August, fifteen bird houses, eighty-two animal cages, eight museum models, and three museum aquariums were made by the campers in the Trailside Workshop. The American Museum furnished transportation, materials, tools, and instruction for all of this work.

The result of this service was that many camps that could not provide museum equipment were thus given exhibit materials that soon proved to be of considerable value in the nature educational life of the individual camps. As a direct result of this activity, at least five of the camps have planned to "carry on" in a much larger way during the next season.

It was our privilege during the camping season of 1929 to cooperate with the camping department of the Interstate Park to a much greater extent than we have ever been able to do heretofore. This was largely made possible because of the automobile supplied to the Nature Trail by the American Museum. This automobile traveled more than 5000 miles, thus bringing nature education to the 90,000 children, who visited the camps during July and August.

The four regional museums in the principal camping centers of the Park received a major share of attention. Individual camps were also served. This work consisted of lending slides and other material, and of giving lectures.

CONSERVATION

GIFTS totalling \$75,000 have been announced by Dr. Frank Aydelotte, president of Swarthmore College, for the establishment at Swarthmore of the Arthur H. Scott Foundation of Horticulture.

This foundation is to be in memory of the late Arthur H. Scott, former president of the Scott Paper Company, who graduated from Swarthmore in the class of '95. The sum total is composed of gifts contributed by his widow, Edith Wilder Scott, '96, of Rose Valley, and his sister, Mrs. Margaret Scott Moon and her husband, Owen Moon, '94, of Winston-Salem, N. C.

The terms of the foundation state that it "is created for three purposes: (1) The founding of an arboretum; (2) the development of floriculture; (3) the promotion of interest in better gardens." President Aydelotte explained that

in the furtherance of these aims, three projects are proposed: the horticultural development of the Swarthmore campus, the Crum Creek region and the Crum-Martin woods, recently given by Dr. and Mrs. Martin; endowment of a chair of horticulture in the faculty at Swarthmore; and the annual award of a medal and a prize of \$1,000 based on a nation-wide competition for outstanding service for better gardens.

President Aydelotte explained that the project for the development of the arboretum would fulfill an early dream and wish of Arthur H. Scott. His enthusiasm as a naturalist and flower lover led him to become a contributor to the Arnold Arboretum at Cambridge, and he always felt the need of a similar undertaking in the Philadelphia region. He knew Crum Creek and its territory since boyhood and college days and believed it was "an ideal location for such a project, having water and high land, rolling land and flat land, rock land and rich land, with all varieties of exposure." Mr. Scott enlisted the coöperation of his friend and classmate, Prof. Samuel C. Palmer, of the Swarthmore Botany Department, of John C. Wister and other horticulturists in and around Philadelphia. The thought of Mr. Scott, left uncompleted by his sudden death in 1927, will now find fulfillment in the undertaking of his widow, his sister and various friends.

THE abnormally long fire season which has harassed the National Forests of the West since early summer has not yet closed, says the Forest Service, U. S. Department of Agriculture, upon receipt of reports in Washington from its forest districts. Dry conditions and dangerous "fire weather" still prevail in most of the western districts, a condition unprecedented in the history of the U. S. Forest Service for this time of year. Forest officers regret that the danger of man-caused fires has made it necessary temporarily to close a number of National Forests to public entry.

This year, up to October 20, approximately 900,000 acres of the National Forests have been burned over and fire suppression has cost \$3,145,000. Combinations of drouth, low precipitation, and humidity, high winds and temperatures, made 1929 an extremely bad fire year.

FISHES

THE will of the late Dr. Bashford Dean, first curator of the department of fishes, and later honorary curator, leaves to the American Museum his ichthyological library and the sum of \$5,000 for its upkeep.

This library, a large part of which is in the Dean Research Room, consists of approximately seven hundred bound volumes and a collection of unbound papers and pamphlets. It is an invaluable asset to the department and to students of both fossil and recent fishes.

The bequest also includes a beautiful and very valuable collection of unpublished embryological drawings made by Doctor Dean himself.

FOSSIL VERTEBRATES

IN a recent issue of *Palæobiologica*, Prof. Julius Vigh of Budapest describes a natural mummy of a house cat. After death the cadaver of the cat dried out thoroughly without decay and has been preserved for more than ten years.

This is of interest as an example of the process by which the skin of some extinct animals has been preserved, particularly that of ground sloths found in caves—one in Patagonia and one in southern New Mexico. It also illustrates the first step in the formation of such fossils as the so-called dinosaur mummy preserved in the American Museum, in which the skin is not preserved but a natural cast of the skin has been formed.

DURING November, Mr. Barnum Brown visited Arizona to investigate dinosaur tracks which had been reported there. He also went to the University of Utah to study the dinosaur collections in that institution.

HONORS

IN recognition of Prof. Henry Fairfield Osborn's splendid work in the field of palæontology, he has been notified of his election as a foreign member of the Royal Academy of Lincei, Italy, in the class of geology, palæontology, and mineralogy of the physical, mathematical, and natural sciences.

OTHER MUSEUMS

IN the hope partly of seeing rich local Indian collections, Curator N. C. Nelson of the department of anthropology in the American Museum, recently made a six weeks' vacation trip through parts of the provinces of Ontario, Quebec, and New Brunswick. All told, ten public museums were visited: the Royal Ontario Museum and the Ontario Provincial Museum in Toronto; the Victoria Memorial Museum (the National Museum of Canada) at Ottawa; the Redpath, the McCord, and the Strathecona museums at McGill University, Montreal; the Ramesay Museum in the old French governors' chateau, Montreal city proper; the Laval University Museum in Quebec city;

the New Brunswick University Museum at Fredericton and the Natural History Museum at St. John, New Brunswick. The list includes probably all the more important institutions of the kind in central and eastern Canada.

These museums vary greatly in size, in age, in purpose, and in importance. One or two are old-fashioned curio places, some are essentially historical museums, and several of the best are well organized departmental institutions serving primarily as adjuncts to the different universities with which they are affiliated. Unfortunately nearly every curator was away on vacation, or else was in the field, so that little could be learned either about past history or future prospects, and the visitor was left to judge merely from appearance. Some of the institutions would seem—after the European manner perhaps—to be monuments to the principal donors as well as places for the preservation of specimens. Everywhere there was shortage of space; but this is about to be remedied in a number of places. Thus St. John is preparing to erect an entirely new and larger building which is to be advanced to the rank of Provincial Museum. Quebec is in the act of finishing what is probably her first Municipal Museum, beautifully situated on the historic battlefield—the Plains of Abraham—recently converted into a public park. The largest and most richly stored institution, the Royal Ontario Museum in Toronto, is also looking forward to expansion in the near future. Indeed, there is evidence in Canada not only of normal progress along museum lines, but of something like a resuscitation in recent years.

All of these museums, whatever their main purpose, contain more or less strictly anthropological material, though—except for the Toronto and possibly the Ottawa institutions—not merely so much of local origin as had been hoped for. However, there was little opportunity for loafing. No American can visit French Canada for the first time without finding himself fully occupied with interesting cultural facts not mentioned in his school histories. Those who are selling Canada to the foreign tourists call these facts "quaint" and "romantic; but the student of culture history is likely to find them of sufficiently deep significance to cause a rearrangement of some of his fixed ideas.—N. C. N.

ORIGIN OF LIFE

THE Energy Concept of Evolution.—Félix Sartiaux, administrative engineer on the Chemin de Fer du Nord, author of numerous and delightfully written archaeological volumes

and essays, translator of Osborn's *Origin and Evolution of Life*, writes as follows on September 4, 1929, regarding the energy concept of evolution and the chromosomal or genetic concept:

A new edition of your fine work, *Origin and Evolution of Life*, would be extremely interesting; there have been, in fact, so many discoveries made since 1917. But your fundamental ideas on the forms of energy are always true. Are we not on the point of discovery of forms intermediate between inert matter and life, in what is called here "les Virus filtrants?" I have read on this subject a very interesting communication to our Academy of Sciences by a French biologist, Honduroy—the theory of the "factors"—and the rôle of the chromosomes is very much in favor among us at present (Caullery, Guyenot; see a remarkable little book, *Les Chromosomes*, by J. Rostand, son of the poet, published by Hachette in 1928, or 1929, which is a very good popular résumé). But I object to much of it; your point of view seems to me superior.

SCIENCE OF MAN

MENTAL Development of Primitive Children.—Doctor Margaret Mead has just returned from a year's leave of absence which she spent in field work in the Mandated Territory of New Guinea, working under a fellowship grant from the Social Science Research Council. Doctor Mead made an intensive study of the young children in an isolated sea village of the Manus tribe in the Admiralty Islands. In addition to an ethnological study of the Manus people, she made an ethnographic survey of some of the related peoples in the Admiralty Islands and collected a large number of specimens for the American Museum of Natural History. This representative collection which contains many specimens of artistic interest will be placed on exhibit in the South Seas Hall in the course of the next few months. Doctor Mead also spent six weeks in northern New Britain, making a historical study of the rôle played by Samoan half castes and Samoans in the development of the Bizmark Archipelago, once a part of German New Guinea, now an Australian Mandate under the League of Nations.

THE American Museum has received a gift from Mr. E. Hope Norton of more than two hundred archaeological specimens from the highlands of Ecuador. The value of this collection is enhanced by the fact that it is accompanied by full data as to the places and conditions when each object was found. Such location data adds greatly to the value of any museum collection. The gift consists chiefly of pottery vessels, stone axes, and stone pottery figurines and pendants. The highly developed technique of metal working attained by the ancient peoples of Ecuador is exemplified in this collection by a number of copper and bronze objects, both cast and hammered, and by a splendid gold ornament decorated in low relief. The relation of the high cultures of Peru and Bolivia to those of Columbia,

Central America, and Mexico is one of the major problems of American archaeology, and its solution must depend partially upon the acquisition of abundant materials from the intervening areas. The collection just given is therefore of more than ordinary interest.

AMERICAN Archaeology.—Every year there come to the Museum a large number of letters relating to archaeological possibilities in various parts of the country. Most of these communications are of the bona fide sort, often well worth investigating; but not a few are merely additional proofs that archaeology still is a peculiar touchstone which readily sends off unwary minds on a course of wild imaginings such as even the hardened professional may not succeed in bringing to a halt. Disposing of these cases in some way or other, there remain for serious consideration many more inviting suggestions than any one institution can possibly attend to. Some correspondents are consequently referred to workers or institutions in their own state and the rest are given satisfaction in some instances by letter, in others by examination of their specimens sent in for the purpose, and, lastly, if circumstances warrant, by an actual visit by a member of the Museum staff.

This year has been no exception to the rule. In the spring many requests for some qualified person to come were on hand from several of the western and middle western states. In an effort to comply, the department of anthropology took advantage of the fact that our newly appointed staff member, Dr. Ronald Olson, was planning to drive his car here from California. The result was that stops were recorded for cursory surveys or test excavations, as the case seemed to require, at no less than thirty-seven different places: two in New Mexico, thirty-two in Texas, one in Oklahoma, two in Iowa, and one in Minnesota. The sites included pueblo ruins, house and village remains of less substantial character, quarry and workshop places, caves with evidence of former occupation, refuse mounds and cemeteries, as well as geological exposures containing flints of colithic type. Small collections of one sort or another were obtained at all but one or two of the places visited, totaling several hundred specimens, all of which have been catalogued and in part placed on exhibit.

The most important data obtained by Doctor Olson, considered both qualitatively and quantitatively, were those from Texas. Texas, for various reasons, is little known archaeologically and not all that is known has been adequately published. The American Museum has hitherto

possessed only a few handfuls of specimens from the great Lone Star State, and this miscellaneous lot has now been increased by about four times. The new accessions are also of miscellaneous character, to be sure, but we at least know where and under what conditions they occurred. The general localities sampled range over the greater part of the state, as follows: Alpine, in the southwest; Brackettville, in the south central; Amarillo, in the northwest; Abilene, in the north central; and Waco, in the east central section. Aside from the skeletal material collected, the artifacts include mealing stones, rubbing stones, hammerstones, red paint stones, notched sinkers (?), flaked blanks of various stages of finish, knives, spear and arrowpoints, end-scrappers, shell spoons or scrapers, shell disk beads, bone awls, notched bones, blunt antler implement, reed arrowshafts (?), checker and twilled matting, twined basketry, two-ply cords, postherds of non-Pueblo type, traces of charred maize and obsidian. The available information, such as it is, seems to warrant the conclusion that while the Texas aborigines had some traits in common with those of their neighbors of the arid Southwest, in general, their culture cannot be grouped with that of the Pueblo Indians proper.—N. C. N.

THE Alaskan explorer, George Thornton Emmons, recently visited the American Museum, bringing the completed manuscript of an invaluable memoir on the Tlingit Indians of southeastern Alaska, which is now in preparation and which will be published by the American Museum Press as a final contribution from this lifelong explorer in our great Northwestern Territory. A lieutenant in the U. S. Navy, the author began his exploration in the year 1882 while still on duty, and is now completing forty years of naval duty and exploration in Alaska and British Columbia, having attained his seventy-eighth year. He is one of the senior explorers of the American Museum, in the front rank in ethnological and anthropological exploration.

LENGTHENING Human Life.—Dr. T. Wingate Todd comments on the relatively brief life of our classic ancestors as well as of men of the Bronze age and men of uncivilized races.

"Some twenty years ago Karl Pearson analyzed the mortality curve of English males and resolved the complex curve into its simpler components with peaks of mortality at three, twenty-three, forty-two and seventy-two years respectively. We may call these the peaks of childhood, adolescence, middle age and old age. *It is the old age peak which is characteristic of modern days.* If we take the records of the Roman colonies in

Africa, we find an attempt at formation of this peak at the same age of seventy-two years, although its apex is there much lower than that of adolescence. This means that the great majority of African Roman citizens died young, though a minority lived to a considerable age."

"In 1925, through the kindness of Sir Arthur Keith, I examined the collection of West African Negro skulls in the College of Surgeons Museum. I found the middle age peak of mortality among these native people the same as among our American Negroes and I found no old age peak at all. In the native Tasmanians of the same museum similar results were encountered. From London I went to a Bronze Age burial place in the English Lake District and on this site among seventeen skeletons, found none over thirty years. From the Lake District I was called across country to Scarborough on the east coast to examine a cemetery of eleventh and twelfth century people. Among the 143 burials the peaks of childhood, adolescence and middle age were readily identified but no old age peak."

THE Miocene Gibbon of France and Germany.—

It is difficult to believe that the tree-living gibbon, now confined to the tropical forests of the East Indies, in Miocene times ranged widely through the forests of France, Switzerland, Germany, and Austria, as described in a recent article by Prof. E. Stromer of Munich under the scientific name of *Pliopithecus antiquus* which was applied to it by the French palaeontologist Gervais a hundred years ago. Doctor Stromer observes:

Pliopithecus is especially an example of how much the paleontological study of mammals is dependent on a single fortunate discovery, and how slow and painful must be its exact progress. One hundred years ago the type of this beautiful fossil of the lower jaw of *Pliopithecus* was found in the French Miocene, and from that day, in correlated strata in other parts of France, Switzerland, Germany, and Austria toothed fragments or single teeth have been found which may be doubtfully referred to the species, but it is only in the lignites of Göriach, Austria, that such fossils, in a crushed condition, have been isolated in any quantity. Over and over the teeth have been studied to the last little point, and conviction has been reached that this species was widely distributed throughout middle Europe in the Miocene, that time in which deciduously-treed forests were partly filled with southern species and various mammals existed whose nearest living relatives today are found only in the primeval forests of Southern Asia, as the Muntjac-Deer and the rhinoceros of the genus *Dicerorhinus*.

The skeleton is still lacking, the very skull of *Pliopithecus* itself is unknown; we do not even know whether the brain-capacity was less than in living species, and above all whether that most striking specialization, the great arm-length, had already developed, if the *Pliopithecus* was completely equipped for arboreal life, as are the living Gibbons.

—H. F. O.

CONTEMPORARY of Heidelberg Man.—

The lower Pleistocene gravels of Bammenthal near Heidelberg are of the same geologic age as the classic sands of Mauer which yielded the type jaw of Heidelberg man, technically known as *Paleanthropus heidelbergensis*. On July 1,

1927, Dr. Wilhelm Freudenberg found in Bammenthal parts of the cranium, face, jaw and scapula of what he believes to be a new primate species and genus named *Hemianthropus osborni* in honor of Professor Osborn on the occasion of his seventieth birthday. The brain surpasses in width that of any anthropoid ape; the face across the gorilla-like cheek bones is extremely broad. The femur of the young *Hemianthropus* when restored is the same length as that of a young chimpanzee. The author describes *Hemianthropus* as an intelligent being with a large brain, surpassing the Trinil man (*Pithecanthropus*) and equalling in size that of *Homo neanderthalensis*. The fragment of the jaw shows that there cannot have been a prominent chin, in fact, it must have been even less prominent than in the Heidelberg man. The lower border rather resembles that of *Pithecanthropus*, the ape-man of Java. The question of the validity of *Hemianthropus osborni* as distinct from Heidelberg man remains an open question.

Recently Doctor Freudenberg found a portion of a broken and water-worn femur which he attributes to a fossil gibbon, *Postpliopithecus hominoides*. In discussing these fossils before the session of the physical anthropologists in 1929 a colleague remarked: "One must praise highly the extreme patience and persistence with which Herr Freudenberg has searched for primate fossils for so many years and in so many places. I wish him and science the happy reward which crowned Schoetensack's equally diligent search in Mauer."

IN Section XIV of South Africa and Science Dr. Raymond A. Dart comments as follows on the Rhodesian and Boskop races:

"It was in 1913, with the discovery, near Potchefstroom in the Transvaal, of a new and unknown, bizarre, big-brained, human type, which has hitherto not been retrieved outside of Africa, the so-called Boskop man or *Homo capensis* of Broom, that the attention of scientists was first seriously directed to the likelihood that South Africa had played something more than a subsidiary role in the early history of the human race. That probability was greatly increased by the finding of a skull in 1921 at Broken Hill with the most bestial, human muzzle known, and with receding forehead and enormous overhanging eyebrows simulating in these features the gorilla. For the reception of this being whose nearest known human relatives were the extinct Neanderthal race of Europe, the creation of a new species *Homo rhodesiensis*, more primitive even than the Neanderthal's, has been necessitated.

Unfortunately, nothing is yet known of its geological age or its geographical distribution.

"With respect to a knowledge of Boskop men, we are in a much more happy condition than with regard to *Homo rhodesiensis*. Between 1923 and 1926 by the unearthing of remains by Mr. Fitzsimons, at Zitzikama, near Port Elizabeth, and by Major T. G. Trevor, at Kalomo in Northern Rhodesia, it was shown that the Boskop type of mankind was a very distinctive one with a widespread distribution in Southern Africa. Mr. H. S. Gear has been able to give us much information concerning the Boskop skeleton and two other points of great importance were established; firstly, that Boskop man preceded the Bushman because his remains have been found at lower stratigraphical levels than Bush remains at Zitzikama and other sites along the coastal area, and secondly, that the type was not so removed zoologically from the Bush type as to rule out hybridisation between the two races. The most startling evidence in this latter respect came from the occurrence in the dissecting room of the Anatomy Department at Cape Town of a typical Boskopoid skull as announced by Professor Drennan in 1925. Actual Boskopoid hybridisation amongst the Zitzikama material of the higher Bush levels at Zitzikama was demonstrated by Dr. Gordon D. Laing (1925)."

BOOK REVIEWS

Audacious Audubon. By Edward Muschamp. Brentano's. 312 pages.

THE romance of the life of John James Audubon, the charm of his personality, and the marvel of his achievements have tempted the pen of numerous biographers, and in the authoritative work of his granddaughter, Maria R. Audubon,¹ and scholarly volumes of Francis Herrick,² we have eminently satisfactory records of his life. The present volume, however, is better adapted to the general reader. Freely acknowledging his indebtedness to the sources mentioned, Mr. Muschamp gives us a more closely woven whole. His well-written story moves swiftly and quickly succeeds in arousing our interest in Audubon the naturalist, artist, and man, and in holding our attention to its closing pages. It pays, therefore, an adequate and effective tribute to this remarkable man, one which should make him and his achievements familiar to thousands to whom he is now little more than a name. One cannot but regret that the author could not have found a title more worthy of his theme.—F. M. C.

¹ *Audubon and His Journals.*

² *Audubon the Naturalist.*

The Desert Road to Turkestan. By Owen Lattimore.

THE beginnings of the caravan trade between China, Mongolia, and what is now Chinese Turkestan are lost in antiquity, but from beyond the memory of man, long files of silent-footed camels have plodded their way across the Gobi Desert, carrying westward the silks and manufactures of China and bringing back skins of wild animals, gold, and jade to the markets of the East. The profession of the caravans is among the oldest in the world, and the business was once so lucrative that great family fortunes were built upon it. It is a world far removed from modern existence; it goes on today, however, almost exactly as it has for centuries. And it is of this World of the Caravans that Mr. Lattimore tells in his well written and beautifully illustrated volume.

In the troubled times of 1926, when he made his journey from Kuei-hua in western China to Ku Ch'eng-tze in Turkestan, political conditions in Outer Mongolia were such that the comparatively easy and well traveled routes through that country had to be abandoned. Caravans, therefore, were forced to use another way to the westward, the dim "Winding Road," least known of all the routes to Central Asia. Though it is an ancient trail, scarcity of water and great areas of sand take a heavy toll of lost camels from the heavily laden caravans, so until just before Mr. Lattimore made his journey, the "Winding Road" had been almost forgotten. He was the first white traveler over it.

The lure of the far places of Inner Asia has drawn many explorers, travelers and adventurers, but few have brought back from their wanderings such a wealth of information. Mr. Lattimore's excellent knowledge of the Chinese language particularly fitted him for the gathering of fascinating sidelights on the lives and customs of the desert travelers who were his only companions. He belonged to no mission or expedition, but, impelled by the urge of the unknown, he went simply "for to admire and for to see." He traveled and lived as a caravan man in a world of caravan men; he ate their food and sat listening among them when they talked of "the prices of wool and camels, of cart-hire, of journeys counted in many tens of days into the remote hinterland of Asia, and of the bandits besetting this road or the soldiers obstructing that."

There is a tremendous amount of all sorts of information in the book, but it is never heavy or wearisome. Delightful anecdotes of the road and striking word pictures of the country and of the

weird existences of the caravan men hold the reader's interest from beginning to end. Nor are thrills lacking—as when, one night on Dead Mongol Pass, a thousand camels were trapped by deep snow and had to be turned around in the darkness and bitter cold. Only one familiar with winter caravan travel in Central Asia can fully realize the almost impossibility of such a feat.

Altogether, *The Desert Road to Turkestan* will take its place among the foremost volumes of Central Asian travel.—WILLIAM J. MORDEN.

"Insects" Volume VII of the Jubilee Issue of Brehm's *Tierleben*. Jubiläums-Ausgabe in acht Bänden-Herausgegeben von Carl W. Neumann. Siebenter Band: Die Insekten. Verlag von Philipp Reclam Jun., Leipzig.

THE newest edition of Brehm's *Tierleben*—a work originally brought out in the sixties of the last century, but republished with revisions and additions at intervals of from ten to twenty years—is designated a Jubilee Issue, for it commemorates the one hundredth anniversary of the birth of Brehm. Although Brehm's name is rightly associated with the series, for he was the author of five of the six volumes that constituted the first edition, Taschenberg was responsible for the section on the insects and for the additions to and revisions of this section in the second and third editions. His name, therefore, is still featured in the present edition as the author of the volume on the insects, but his text, as the title page tells us, has been thoroughly recast by Carl W. Neumann.

In the new edition the reader will find amplifications in some parts, but in general there has been condensation both of subject matter and of statement, with the result that the compass of the book has been reduced by possibly one half. Attention is focused on the insects exclusively by the elimination from the volume of the spiders and of other invertebrates that competed for space with the insects in the earlier editions. These have doubtless been relegated to some other volume of the series, and their interesting habits certainly entitle them to independent treatment.

Taschenberg in his day was confronted by the bewilderingly rich fauna that clamored for inclusion in his volume. He decided the question, as he tells us in the second and third editions, by giving preference to common, native forms, and including only to a limited extent exotic insects. This is the method pursued also in the present edition, which even eliminates some of the foreigners to which Taschenberg had given often

more than passing attention. Indeed it would be impossible for anyone to begin to tell in the space available more than a fractional part of all that is known about insects, and the tendency of Doctor Neumann still further to strengthen the focus upon the native fauna by limiting the quota of eligible aliens, far from being a defect, is, under the circumstances, a virtue.

While in general the work is one to be commended for its authoritative character, it contains some errors, the result of carelessness often rather than of unfamiliarity. Thus on page 47 the number of described species of ants is referred to as 4000, but on page 71 as 5000. The latter figure is nearer the truth. On page 83 the impression is given that the young queen sets forth with the new swarm of honey bees; on page 94 this rôle is correctly assigned to the old queen. Without wishing to undervalue the important researches of Möller, the distinction of being the "first investigator" of the leaf-cutting ants belongs rather to Belt, who reached the conclusion that the leaves are employed not as food but for the rearing of "a minute species of fungus, on which the ants feed." The statement (p. 105) that there are only two species of *Eucera* in Germany should be qualified by the phrase "common species," as other *Eucera* of rarer occurrence have been reported. There seems no need, in view of the researches of Sladen and others, to express uncertainty as to the agency through which the larvæ of *Psithyrus*, the inquiline in the nests of *Bombus*, are fed. Additional infelicities of this type might be cited.

Unless the lay reader is unfamiliar with simple German, he need not be deterred from reading the volume. The subject matter is presented without ensnaring technicalities, and the fact that the insects are predominantly European rather than American should not alienate the reader's interest as many close relatives of these insects with similar habits are represented in our own fauna.

The volume contains eight illustrations in color and sixty-four in black and white. Among the illustrations some are duplications of the previously issued plates of Flanderky and Specht, while others represent the work of a new collaborating artist, Franz Schmidt-Kahring.

—HERBERT F. SCHWARZ.

"Field Book of the Marine Fishes of the Atlantic Coast from Labrador to Texas." By Charles M. Breder, Jr.

TO the series of Putnam's *Nature Field Books*, there has recently been added a "Field Book of the Marine Fishes of the Atlantic Coast from Labrador to Texas" by Charles M. Breder, Jr.

of the New York Aquarium, who is also a research associate in the department of ichthyology of the American Museum of Natural History. It contains keys for identification, a very full series of outline figures of the many species of salt-water fishes of our coast, which will be helpful to the same end, and a number of attractive color plates and half tone reproductions from photographs. All in all this book should prove invaluable to the salt-water fisherman or casual seashore visitor who wishes accurate knowledge of all the different kinds of fishes met with, and we know of none other that will serve this purpose. It is an attractive little volume of convenient pocket size, and whereas the sales price of five dollars might seem excessive, one must bear in mind the large amount of information and the many illustrations which it contains.

—J. T. N.

LOUIS CAPITAN

WORD has recently come of the death, on September 1, of Dr. Louis Capitan, the veteran archaeologist of Paris. Doctor Capitan was born in 1854, and although he held a medical diploma, was a member of the Academy of Medicine, and an officer of the Legion of Honor with military title for war service, he occupied himself from early youth largely with problems of prehistory, including those of the two Americas. Years ago he visited Mexico and the United States, and he was one of the few Europeans who continued to write affirmatively about Paleolithic Man in America.

According to his own words, Capitan began his public career as archaeologist by exhibiting

his collections at the Paris Exposition of 1878. He remained an indefatigable collector almost to the end and was consequently the possessor of a tremendous amount of material, the bulk of which he left as a legacy to the French National Museum at St. Germain, where a hall is especially reserved for its display.

As a field investigator Capitan took a leading part, from 1893 onward, with his pupils Breuil, Peyrony, and others, in the investigation of the French caverns, helping to institute the stratigraphic method of debris excavation and a similarly refined technique for deciphering the remarkable engravings and paintings preserved on the cave walls. As a result, we may assume, he later became a member of several different civic commissions for the preservation of monuments, historic and prehistoric, holding various offices, including that of president.

As a teacher Capitan was equally active. In 1899 he succeeded Gabriel de Mortillet in the Chair of Prehistoric Anthropology at the Ecole d'Anthropologie. At some unknown early date he was also made Loubat Professor of American Archaeology at the College de France. He wrote vigorously almost to the last and kept up his lectures until past seventy.

It was the writer's pleasure to hear Capitan lecture as late as 1922, as well as to travel and work with him for a number of weeks in Belgium, Holland, and England. With him may be said to have passed the last of the distinguished group of men who first made us properly acquainted with the character and culture of Paleolithic Man.—N. C. N.

OUR CONTRIBUTORS

A chance association in early boyhood with such well-known ornithologists as T. S. Palmer, F. H. Holmes, and C. H. Keeler, furnished the stimulus that started **Rollo H. Beck** on his career as a bird collector. He has studied and collected the land and sea birds of North and South America from Alaska to Cape Horn, and in his quests he has experienced all the thrills of shipwreck, and even hunting for lost treasure on desert ocean isles.

In 1920, Mr. Beck started on a collecting trip to the South Seas for Dr. Leonard C. Sanford which lasted eight years. Following this he spent a year in New Guinea collecting birds of paradise. He tells about this trip in the present issue under the title of "A Collector in the Land of the Birds of Paradise."

Lee S. Crandall, author of "To New Guinea for Living Birds of Paradise," has been associated with the department of birds in the New York Zoological Park since 1908. He became curator in 1919, and has made a number of expeditions, principally to South and Central America to obtain birds for the Zoological Park. The expedition to New Guinea was the most important, and was the culmination of many years of hopes and planning.

No one is better qualified to tell the history of the Pare National Albert, Africa's great gorilla sanctuary and biological survey station, than **Mrs. Mary L. Jobe Akeley**, the widow of the late Carl Akeley with whom the idea of the Sanctuary first originated.

Carl Akeley passed out on his last expedition before his plans were consummated, but his widow valiantly brought to completion his part of the work of the expedition, and she is now advisor and assistant in the work of the Carl Akeley-African Hall at the American Museum. "Africa's Great National Park" is a chapter from Mrs. Akeley's new book, *Carl Akeley's Africa* which is to make its appearance this autumn.

Paul Griswold Howes, curator of the Bruce Museum of Natural History and Art at Greenwich, Connecticut, was the leader of an expedition for this Museum to Dominica, British West Indies, in 1926, and again in 1927, in company with Dickenson S. Cummings. The purpose of the later expedition was to climb, measure, and make photographic records of the two highest mountains in the islands and to make studies of Dominican wild life. "The Mountains of Dominica" tells the story of how this was accomplished. Messrs. Howes and Cummings are working out a schedule of expeditions to various parts of the world which will be undertaken by them every other year for the purpose of gathering zoogeographical data and collections for the Bruce Museum.

The earliest boyhood interest of **Barnum Brown**, author of "A Miocene Camel Bed-ground," was collecting fossil shells in the Coal Measures of Kansas, and this interest determined his future career. After graduating from the University of Kansas, he joined the scientific staff of the American Museum, with which institution he has been

affiliated since 1897. He excavated the first dinosaur for the American Museum, and the great hall of fossil reptiles has been built up under his direction. His explorations in the Americas have taken him from the Arctic to the Antarctic.

He is the author of many popular and scientific articles, a number of which have appeared in *NATURAL HISTORY*.

"A Bit of Japan in Miniature" describes in this issue the first large anthropological group built by **V. Roror Short**, a young artist in the preparation department of the American Museum.

Mr. Short originally planned to become a civil engineer, and the practical work in wood turning, pattern making, and foundry work which he did to prepare himself for such a career, gave him a valuable background for making the

models for the Museum groups. He studied at Pratt Institute, concentrating on design, modeling, and interior decorating, and later came to the department of lower invertebrates at the Museum to do modeling and wax work on exhibits portraying marine life.

The cover design for this issue of *NATURAL HISTORY* is from a painting by **F. L. Jaques**, of *Paradisara apoda augusta victoriae*, named in honor of Kaiserin Augusta Victoria in 1888. It is now regarded as a geographic race of *P. apoda*, a species in which the long flanks vary from yellow to red according to the regions inhabited by the several races. The name *apoda*, or footless, was suggested by the old belief that birds of paradise had no feet, and spent their entire lives in the air. Augusta Victoria's paradise bird is found only along a short section of the northeast coast of New Guinea.

Facts concerning other authors have appeared in former issues.

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NATURAL HISTORY, published bimonthly by the Museum, is sent to all classes of members as one of their privileges. Through NATURAL HISTORY they are kept in touch with the activities of the Museum and with the marvels of nature as they are revealed by study and exploration in various regions of the globe.

AUTUMN AND SPRING COURSES OF POPULAR LECTURES

Series of illustrated lectures, held in the Auditorium of the Museum on alternate Thursday evenings in the fall and spring of the year, are open only to members and to those holding tickets given them by members.

Illustrated stories for the children of members are presented on alternate Saturday mornings in the fall and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members. When visiting the Museum, members are also privileged to avail themselves of the services of an instructor for guidance.

SCIENCE
EDUCATION



RESEARCH
EXPLORATION



FIFTY-NINE years of public and scientific service have won for the American Museum of Natural History a position of recognized importance in the educational and scientific life of the nation and in the progress of civilization throughout the world. With every passing year the influence of the Museum widens, as is witnessed by the increasing number of visitors who daily enter its halls without the payment of any admission fee whatever.

THE NEW SCHOOL SERVICE BUILDING, with the increased facilities it offers, makes it possible to augment greatly the Museum's work not only in New York City schools but also throughout the country. Fourteen million contacts were made during 1928 with boys and girls in the public schools of New York and the vicinity alone. Inquiries from all over the United States, and even from many foreign countries, are constantly coming to the School Service Department. Information is supplied to, and thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can properly be considered not a local, but a national—even an international—institution. Through its loan collections, or "traveling museums," which are circulated locally, 557 schools were reached last year, and 2,282,192 direct contacts were made with the pupils. More than a million lantern slides were lent to the New York City schools, and 4,851 reels of the Museum's motion pictures were shown in 223 public schools and other educational institutions in Greater New York, reaching 1,576,249 children.

COLLEGE AND UNIVERSITY SERVICE. The President and the Curator of Public Education have extended and intensified the courses of college and university instruction. Among the institutions with which the Museum is coöperating are Columbia University, New York University, College of the City of New York, Hunter College, Rutgers College, University of Vermont, Lafayette College, and Yale University.

LECTURE COURSES, some exclusively for members of the Museum and their children, and others for schools, colleges, and the general public, are delivered both at the Museum and at outside educational institutions.

THE LIBRARY is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, an attractive reading room is provided.

MANY POPULAR PUBLICATIONS, as well as scientific ones, come from the Museum Press, which is housed within the Museum itself. In addition to *NATURAL HISTORY*, the journal of the Museum, the popular publications include many handbooks, which deal with subjects illustrated by the collections, and guide leaflets, which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, comprise the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments, aside from anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matters. The Librarian of the Museum, who may be addressed in care of the Museum, may be called upon for detailed lists of both the popular and the scientific publications with their prices.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1928 thirty-four expeditions visited scores of different spots in North, South, and Central America, Asia, Africa, and Polynesia, and nearly as many are now in the field continuing last year's work or beginning new studies.

From these adventuring scientists, as well as from other members of the Museum staff, and from observers and scientists connected with other institutions, *NATURAL HISTORY MAGAZINE* obtains the articles that it publishes. Thus it is able to present to the constantly enlarging membership of the American Museum the most fascinating and dramatic of the facts that are being added to the Museum's knowledge, or are deposited in this great institution.

THE AMERICAN MUSEUM OF NATURAL HISTORY

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NEW YORK, N. Y.

